THE HUMAN HAND

1 Leonardo da Vinci: *Hands*

THE HUMAN HAND

A Psychological Study

BY

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TRANSLATED BY
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TRANSLATOR'S FOREWORD

It is a great pleasure to introduce to the English reader this distinguished book, which I have had the privilege of translating, though the translation is in many respects inadequate. Prof. Géza Révész, who was counted among the most eminent of psychologists and whose numerous works are widely read in Europe and America, was for long deeply interested in the world of touch and the psychological problems of the blind. In this book he brought together in compact and concentrated form all his extensive studies and researches in this field. It is indeed the only book known to me in which all the fundamental problems of the hand—its evolution, functions, social, religious, aesthetic and magical aspects—are discussed. The author gave of his best to this book so as to embody the fascinating content in suitable literary form and style.

The book should interest a wide and varied public. Students of biology, medicine and anthropology will learn that the hand is not merely an anatomical appendage but an expressive organ, an instrument of culture, art and language, a prototype of tools and implements of work, a symbol of great religious and magical significance, and a means of diagnosis and therapy.

Prof. Révész showed rare perceptiveness and insight as well as scholarship in presenting the human hand in its full dignity and worth.

JOHN COHEN

PREFACE

In connexion with my researches into the sensory world of touch in recent years, I have studied with growing interest the activity of the hand. The deeper I probed into this subject the more clearly did I grasp the significance of the hand in our psychical and social life. The results of my studies soon reached out beyond the relatively narrow confines of psychology and I gradually felt the need to bring them together and present them for publication.

In this small book the attempt is made for the first time to represent the function of the hand in all its diversity. It will become evident that there is scarcely a domain of social life in which the hand does not play a distinctive role. The hand makes its appearance everywhere, at least in one of its functions: wherever man works, shapes things, communicates his experiences and enters into contact with his fellow-men.

I hope that I have succeeded in giving a full and coherent picture of the manifold spheres in which the human hand functions.

G.R.

Amsterdam, August 1948.

NOTE ON THE ENGLISH EDITION

Although twelve years have passed since the appearance of this book, *The Human Hand*, I have not made any essential modifications of the original text. I have only added a few paragraphs in Section V (D) The Expressive Function of the Hand.

I would like to express my sincerest thanks to my colleague Prof. John Cohen of Manchester for his excellent translation, which will no doubt contribute to the interest in my book.

Amsterdam, September 1955.

I

Introduction

The entire development and history of mankind is symbolized in the hand.

ON a mural of the Sistine Chapel we see how God as creator touches with his own hand the hand of Adam, to grant him life and spirit by this means. The selfsame human hand has engraved on two holy tablets of stone man's duties to God, himself and the community. Christ achieved miraculous healings by placing his hand, and with the hand he scattered his blessings.

Jan van Eyck's hand painted the picture on the altar of Ghent, Phidias moulded the deities of the Parthenon and Michaelangelo designed the dome of St Peter's.

With his own hand King John signed the Magna Carta, thereby reinforcing the basis of the English constitution; and William of Orange did likewise for the Charter of the Union of Utrecht, the foundation of the unification of the Netherlands.

The hand created our entire civilization and culture. We owe to the hand all the tools of labour employed in the service of social life. The approach to the microscopic and stellar worlds was made possible by hand-polished lenses. By word and gesture we express our thoughts, our feelings, and aspirations and enter into communication with our fellow-men. Even the realization of our ideas, intentions and aims presupposes a mentally controlled and intellectually directed hand.

It was with the help of his hand that Aristotle immortalized his *Metaphysics*, Newton his *Principia*, Goethe his *Faust* and Beethoven his Pastoral Symphony.

We come into the world with moving hands; with folded hands we are laid in the grave.

The activity of the hand runs through the whole history of man and the life history of the individual.

II

The Phylogenetic Development of the Hand

THE forms of living organisms found on the earth have not always been the same. Hundreds of thousands of years ago the wealth of diverse forms was vastly different from that which we now find on the earth's surface. Palaeontology, the science which concerns itself with fossilized organisms found in the various layers of the earth's crust, has uncovered a great variety of organisms which diverge from those now living, and the deeper they are stratified in geological formations, the more they differ. Every great geological period has its own fauna and flora and is characterized by the presence of definite kinds of living creatures. Since the time of Cuvier (1769–1832) and Lamarck (1744–1829), our knowledge of fossil forms has grown, and thanks to more advanced methods of research we have progressed so far as to be able to reconstruct the organic world of primeval times and thereby to determine the manner of life that once existed and its distribution in space and time.

Palaeontological research and comparative morphology, together with evolutionary ideas which have become prominent since Charles Darwin (1809–1882), have led to the study of phylogenetic developmental series according to which our present organic world is seen as a product of a process of development extending over an extraordinarily

long period of time. In this development, certain forms, for example the vertebrates, display various far-reaching transformations whilst other forms, for example, the protista, have been preserved from earlier times with comparatively little change. Although this fruitful conception is not accepted on all sides, as in the days of T. H. Huxley and Haeckel, it has nevertheless been sustained in its essentials.

For the purpose of our problem we are interested in an apparently small part of the organic world, namely the phylogenetic development of the hand. It cannot be doubted that, like the skull, teeth and other skeletal parts, the hand has by gradual improvement attained that form which we meet in present-day man.

On the assumption that man, in the history of species, belongs to the primates, we must suppose that he has achieved his present structure over a long route. If we begin with the hypothesis that present-day anthropoid apes belong developmentally and morphologically together with man to *one* great group, which may be traced back to anthropoid apes of Tertiary times, then the diluvial remains of anthropoid types, and up to a point even recent anthropoids, can give us an idea how the hand developed to human form over the immense period.

Unfortunately the few remains of apes which have survived in fossil form, particularly of the supposed ancestors of present-day anthropoids (*Dryopithecus*, *Paleopithecus*, *Australopithecus*) are so scanty and fragmentary that they can provide no answer to our question.[1] There is therefore nothing else for us to do than to turn to the earliest fossil remains of the hominides. Most palaeontologists and prehistorians agree that they must be fitted in as transition

[1] M. Boule, *Les hommes fossiles*, Paris, 1924.

members, the 'missing link', in the chain from anthropoids to man in primeval time.

We need not decide whether it is justified to include *homo sapiens* in a developmental series which derives from the anthropoid apes and leads to man. We should have to find in this series a middle member which is neither ape nor man. Whether such an 'animal man' ever existed cannot be said. His origin would have to be dated from the lower palaeolithic period or the end of the tertiary period, that is, a time in which *homo sapiens* certainly did not exist. Even if we supposed that the fossil remains of such a transitional type could be discovered, the question would still remain open whether this creature represented a middle member between animal and man psychologically and not only in craniological detail.

In view of the fact that such a middle member has not yet been found we must take our stand in relation to the hypothetical phylogenetic development of the human hand on discoveries of the remains of extinct anthropoids. These finds so far as our main point is concerned are very limited in quantity: in the case of *Pithecanthropus erectus* (1891) a skull, an upper thigh bone and three teeth; and in the case of *Sinanthropus Pekinensis* (1924) several fragmentary skeletal remains. These very significant remains of prehistoric times need not enter into our discussion because the skeletal part of the hands are completely missing. The fossil remains of the middle palaeolithic period, to which the numberless remains of Neanderthal man belong, are hardly better placed in this respect. And the same is true of the fossils of the upper palaeolithic which include the earliest forms of *homo sapiens*, the so-called Aurignacian, Crô-magnon and Grimaldi man.

A complete skeleton of the hand of Neanderthal man has

not been preserved. If we base our judgement on the reconstruction of Neanderthal man by La Chapelle-Aux-Saintes, the fingers were much longer than ours. The shape and posture are nearer those of the ape hand. This accords well with the view of Boule who held that Neanderthal man differs from all contemporary human types, even the most primitive. Many remains of hands have survived from the various types of diluvial *homo sapiens* (Crô-magnon, etc); but I have not been able to determine whether they have been measured and compared with ape and human hands. In view of the circumstance that the Crô-magnon skull lies entirely within the range of variation of recent man, we must conclude that no essential difference has arisen between the hands of neolithic and those of present-day man. It follows that the skeleton of the hand in the last twenty-five to fifty thousand years has undergone no essential change.

The function of the hand is not, however, determined by its anatomical structure alone; apart from its dependence on bone structure it is also influenced by adipose tissue, muscles, curvature and elasticity, and to no less extent, by the degree of independence and interplay of the individual fingers. But these cannot be studied in the fossil findings. What we can do is to compare the hands of contemporary peoples and races at different levels of culture, and we can also compare the human hand with that of apes, especially with that of the anthropoid apes. The latter comparison is of special interest because it gives the opportunity of showing that the general idea of the hand may easily lead to false conclusions and misunderstandings.

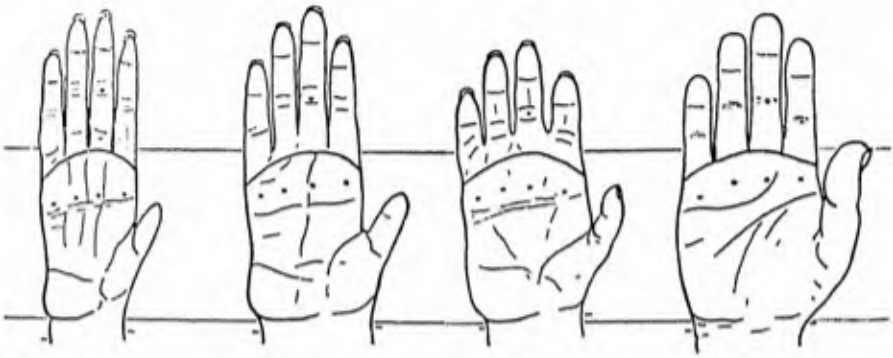
III

The Human and Animal Hand

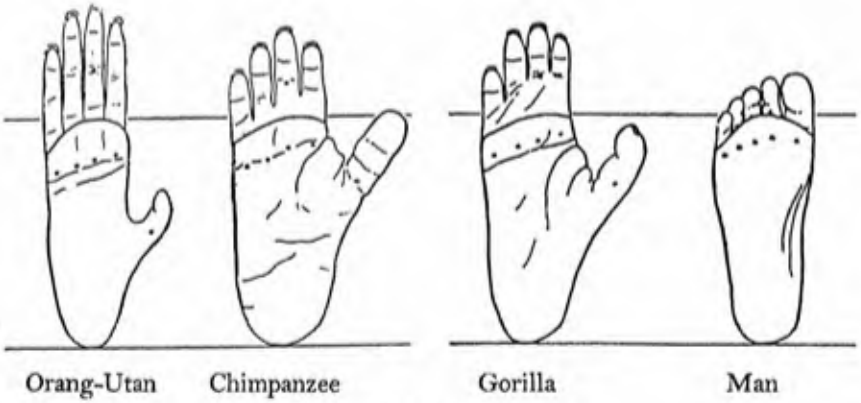
(A) MORPHOLOGICAL

IF we observe apes in all their agile activities we are struck by the nimbleness and dexterity which they demonstrate in their jumping and climbing. There are apes that surpass any acrobat; they fly through the air like an arrow. For a grown-up gibbon, a distance of 8 to 10 metres presents no difficulty. In their activities, apes make use of *hand and foot*, and occasionally of the tail in the same way. The similarity in form and function of both extremities is so great that with certain reservations, we could designate the hand as a foot-hand and the foot as a hand-foot. If we place weight on the not very differentiated capacities of hand and foot, it will doubtless become clear whether we should count apes among two-handed or two-footed or even among four-handed or four-footed creatures. Indeed, the ape, according to what he is doing, is at one time closer to one group and at another time closer to another group. If the orang plays with a ball in sitting posture or if he carefully lifts a cup to his mouth, he gives the impression of being two-handed; if he goes around supporting himself with two hands he behaves as if he were a quadruped. Presumably this last form of behaviour has led to the idea that anthropoids are descended from a four-footed type of ape.

It is interesting to see how the hand gradually becomes differentiated from the foot the higher one ascends in the ape series. Among the pro-simian types the difference is



2 Anthropoid and human hands



3 Anthropoid and human feet

still rather slight, as the *lemuroid perodicticus* demonstrates. The difference appears more clearly among the lower apes, for example, the *cebidae* (cebus) and more clearly still

among the anthropoids.[1] The feet of various kinds of apes do not vary essentially. Among all of them the thumb of the foot lies very low and separated off from the rest of the fingers, in a way corresponding to the thumb of the hand. Illustration 3 shows this very convincingly.[2] The marked differentiation of the extremities which accompanies the biological stages of evolution is remarkable. The feet of the three great groups of anthropoid apes, namely the orang, gorilla and chimpanzee, are hardly distinguishable. The large gap lies between the anthropoids and man. The human foot has completely lost any prehensile character and has become adapted, as a result of erect posture, to a balanced locomotion, acquiring thereby a new function and form diverging from those of the hand. Whereas the difference between the foot of man and ape is striking, a rather close correspondence is noticeable in comparing their hands. This correspondence reveals itself in the first place in the so-called *finger-formula*. The sequence of the fingers according to size is the same in both cases, namely, third, fourth, second, fifth, first fingers. Only the gibbon, with his love of jumping, departs from this pattern. His arrangement is 3, 4, 2, 1, 5.

In its *form*, the human hand bears the greatest resemblance to that of the gorilla. But this impression of similarity only remains so long as we limit ourselves to schematic form. If we compare the hands as they are in fact it is hard to establish any likeness between them.[3]

In spite of their great adroitness and dexterity the hands of the ape are much inferior to the human hand. The inferiority in the capacity for adaptation and plasticity is

[1]Ch. Midlo, *American Journal of Physical Anthropology*, 19, 1935.
[2]C. M. Beadnell, *A Picture Book of Evolution*, London, 1934, Figs. 171 and 172.
[3]G. Révész, *Die Formenwelt des Tastsinnes*, Den Haag, I, 1937. *The Psychology and Art of the Blind*, London, Longmans Green & Co., 1950.

manifested in their anatomical structure, especially in the size and location of the thumb in relation to the other fingers, and in the part played by the thumb in gripping and moving.

Among most apes the *thumb* is poorly developed; it is least undeveloped in the chimpanzee and gorilla. In relation to the other fingers it is remarkably small, situated

4 The hand of a gorilla and of a man

low on the hand and far from the other fingers. The opinion has often been expressed that because of the unfavourable position of the thumb in the ape hand, apes, including anthropoids, lack the *opposed* thumb. This however rests on inaccurate observation. Not only anthropoids but the lower apes as well and even, indeed, a considerable number of pro-simian types possess an opposed

thumb. As they cannot bring all the finger tips into contact with it because of its small size and low position, it loses much of its mobility and usefulness.

The opposition and flexibility of the thumb has a great significance for techniques of work. Because of the thumb we are able to hold an object within the hand as we please, and to touch it on all sides. If the function of the thumb is restricted because it is short and undeveloped, there is only one manner of touching an object on all sides, that is, by *rolling* it within the hand. We can, in fact, observe this rolling touch in all anthropoids when they take hold of small objects. This thumbless grip and touch makes clear to us the frequently observed passive and at times negative mode of anthropoid behaviour whereby they have difficulty in releasing an object that they have once grasped. Keepers of apes regard this reaction as voluntary and intentional behaviour; and so they make use of the method, successful in the nursery, of diverting the animal's attention and so relaxing the muscular tension of his fingers. The diversion of attention indeed diminishes the muscular contraction, separates the fingers from one another and frees the object from the firm clasp. It should not be assumed that the strong tension and pressure of the fingers in gripping a thing is as futile as it appears at first sight. For when the counter-pressure of the thumb is removed, the position of an object held only with four fingers is no longer ensured. It is therefore in the highest degree purposeful for the ape to grasp an object, such as the keeper's hand, energetically and with a constant pressure. The correct description of the above mentioned passive manner of behaviour should accordingly not be: the ape is *unwilling* to release the object from his hand, but he *cannot* do so.

The thumb does not only serve as a point of support and protection; it also makes it possible to bring things into a desired position, to change them quickly and accurately, and to adapt oneself to the continuously varying pressure relationships. The essential significance of the thumb lies in these functions, and the human hand receives from them its *instrumental character* and the general possibility of employment.

(B) FUNCTIONAL

From the biological standpoint it is often emphasized that the improvement of the hand and its many-sided usefulness were of great significance for the morphological and functional development of the brain and, thereby, for the intellectual progress of mankind.

The hand, the development of which played such an important part in our adoption of an erect posture, cannot be overrated in its significance for man. In this connexion, we shall indicate the relation between the activity of the human hand and anatomical and physiological suppositions about speech whereby the locomotor function of the hand and arm is brought into localized relationship with the region of the brain serving speech. This relationship is naturally a mutual one. The function of speech also, in its turn, exercises an influence on the morphological and functional development of the hand; endowing it with the capacity to express our desires and emotions, in gestures whereby mutual understanding between people is made possible, or at least facilitated.

As with the bodily organs in general, so also with the hand in particular, form and function are closely tied with

the extension of needs. The greater and more diversified the claims made upon it the finer and more differentiated in form the hand becomes. The ever-growing needs of man in culture and civilized life make the once barely differentiated and awkwardly moving hand of prehistory into a hand which, through its exceedingly high mobility and capacity for expression, is capable of the greatest achievements.

However impressive the difference between the hand of a cultured person and that of a prehistoric or primitive man may be externally, there can be no question of any fundamental difference. People at a primitive level in the past possessed and still today possess a hand which is fundamentally equipped with the same functions as our own hand. Primitive man also works, touches, recognizes and shapes objects, expresses his feelings, thoughts and desires with the help of the hand. If he did not do this he would not be a man. As the ape is not in a position to carry out these activities or to do so only in a very modest degree, his hand remains an organ of grasping, regardless of the degree of dexterity and mobility with which it is equipped and of the sort of movements which, through natural endowment, exercise and training, it may be capable. Between an organ of grasping and an expressive hand there is a large gap, which man alone has succeeded in bridging.

Between hand and need there exists a reciprocity of action; needs shape the hand and the hand creates new needs and discharges those tasks which arise from these needs. So long as the hand only has to master tasks in the vital sphere of life, it remains animal-like, confined to its pure biological functions, morphologically primitive, and incapable of development. If, however, needs of social, cultural and civilized life arise, then the hand acquires its

human character, through its working, forming and expressive functions. The mental functions or more precisely those aims that the mind envisages as being realizable through the activity of the hand endow the hand with its *human* character.

IV

The General Significance of the Human Hand

(A) MANIPULATION[1]

IN German the notion of 'Handeln' embraces all meaningful and goal-directed human activities. It characterizes unequivocally the total personality of man. This idea is not limited to external manipulation, that is, actions which effect changes in the outer world. It also includes inner action, the purposeful activities of the mind. In his mode of manipulation man experiences his real 'I'. Through it he acquires power over physical nature, gathers a rich fund of material from experience, enlarges his range of effectiveness, and develops his capacities. Our manipulations serve the more or less conscious claims of impulse, satisfy the drive for power, but at the same time they realize the highest strivings of the human spirit. So we include under this broad conception of 'manipulation' not only the deliberate acts of the adult, but also the sensible activities of young children, regardless of whether they are spontaneous, instinctive, or habitual. In spite of the wide scope of the German expression 'Das Handeln', the word itself points with special emphasis to what the hand does. It may perhaps be conjectured that the word

[1]This is an inadequate translation of the German 'Das Handeln', for which there appears to be no good English equivalent.

originally referred to the meaningful and goal-directed activity of the hand and was only later, by analogy, applied to other activities of the most varied kind.

The general significance of the human hand lies therefore in its manipulative function. Man is induced to various forms of manipulation by his conscious and unconscious strivings, by his desires and by the goals towards which he aspires. Impulses, aspirations, wishes, decisions press for realization, and this takes place chiefly through the mediation of the hand. There is no occupation which can dispense with the hand, and we can scarcely think of a situation in the waking state or in normal circumstances in which a man refrains completely from any purposive movement of the hand. Any activity involved in domestic affairs or in technical tasks as well as the practice of the plastic arts and music demands the hand. Speaking itself seldom occurs without some movement of the hand. Gestures support and supplement spoken language. Even in intensive intellectual work some 'outer' action is manifest: we consult a book, we jot down our ideas as they come, we play with our fingers, smoke a pipe, take a sip of coffee, and so on.

The ability to act in practical fashion is one of the chief criteria of a life governed by the will. All manifestations of a child's will-power are recognized in his movements; in the first instance and at the earliest stage in gestures and actions. When the infant is no more than five or six months old we can observe in him actions which are purposive and presumably guided by certain images, even though it is only in the second year of life that intentional acts are carried out through co-ordinated movements adapted to the goal. Observations of young children teach us that the first and most important habits are connected with the

mechanism of grasping. The grasping of desired objects, in particular reaching for the bottle and bringing it to the mouth, represent the earliest patterned actions of the young child. Grasping is a complex movement of the arm, hand and fingers that at a very early stage functions purposively on the basis of an inherited disposition. Before the child attains the rudiments of manipulation, that is, makes use of grasping, he reacts to outer and inner stimuli with his entire body in undifferentiated and abrupt manner. Gradually the superfluous, unco-ordinated movements of head, back, legs, feet, and toes diminish and the activity of the hand gains the 'upper hand'.

Most of the child's movements are connected with tasks carried out by the hand. Stimulated by an inborn drive to activity, the basic manual habits such as grasping, reaching, turning, twisting, opening, closing and the like, are successively acquired. By means of actions performed by the hand, the most complete and accurate habits are shaped.

The hand's great adaptability and resourcefulness exert an extraordinarily challenging effect on the activity of the mind, and vice versa. All handicaps or injuries to the capacity for manual movement have an unfavourable influence, directly or indirectly, on the mental faculties, and consequently on the entire personality. Inhibitions, confusions, slips and omissions of movement are grave symptoms of mental illness and other general disturbances of the mind. This is strikingly shown in motor apraxia, in the incapacity to carry out an action in spite of the fact that mobility is preserved, that is, an incapacity to move the parts of the body, and especially the hand, in a manner which suits the purpose. In these disorders, the simplest movements are performed in a clumsy, incomplete or interrupted way, and every disposition to finer manipulation is

lacking. The motor functions are disturbed and their tempo retarded among countless mentally disordered patients. Psychiatric experience teaches us, furthermore, that most children who are handicapped in motor functions are generally handicapped or backward. Motor retardation, as a rule, is a sign of definite lesions in the central nervous system.

The close connexion between mind and manipulation manifests itself particularly in the success that we attain with feeble-minded children by systematic training of hand and fingers and by repeated performance of simple actions: It seems that it is more important to develop the hands of such children rather than to lay weight on proficiency in reading, writing and arithmetic. We must attach the same significance to planned exercise of hand-movements in training the blind, the deaf and the dumb, because of its general educational value and with a view to a later occupation.

From these considerations it follows that the hand must be regarded as a harmonious part of the personality. Those maimed in both hands lose much of their individuality because they are exceedingly restricted in their actions and because, with gestures precluded, their capacity for expression is very deficient. The belongingness of the hand to the entire psycho-physical organism is brought out specially clearly in the fact that even a prosthesis must be adapted to an existing psycho-physical mechanism. So it is not only a question of technical soundness but also of taking account of the patient's personality.

Everywhere we see the significance of manipulation, and everywhere it is the hand that manipulates. The whole life of the individual, man's struggle for existence, is filled with 'action-movements', guided by the intellect and the will. In the unfolding of physical and mental qualities,

in the exercise of an occupation and in the realization and objectification of tasks set up by ourselves or by society, the activity of the hand is always prominent.

(B) OBSERVATIONS FROM THE POINT OF VIEW OF THE LINGUISTIC SCIENCES

It is therefore only natural that most ideas of action are borrowed from the achievements of the hand in touching and grasping. The metaphorical use of these concepts leads to the idea of mental 'manipulations', that is, to the activity of a mental and moral personality.

The metaphorical application of designations and ideas connected with the activity of the hand are encountered in the most diverse spheres of human life. If we wish to convey that we have acquired something mental, we say that we have *grasped* it.

The general notion of mental acquisition we express by the word 'comprehend' (*erfassen*). The words 'comprehension' (*Begriff*) and 'comprehensible' (*begreiflich*) point most clearly to the activity of the hand. Even the word 'impression' (*Eindruck*), in the sense of an influence on the mind, and the word 'expression' (*Ausdruck*), in the sense of a reaction to an impression, are borrowed from the tactile-motor sphere. Likewise, words like 'dismember' (*zergliedern*), 'dissect' (*zerlegen*), maintain (*behalten*), display (*auslegen*) turn over (*überlegen*) may denote actual activities of the hand as much as they may relate, in the transferred sense, to mental activities and achievements.

No expressions are more apt to describe inner mental states than those borrowed from the activity of the hand: 'something moves me', 'I am gripped', 'I am held'. In the

moral sphere we find, among other instances, the following images: 'to lay the hand on the heart', 'the helping hand', 'to wash the hand in innocence'. Duties are designated by similar expressions: 'a handshake', 'an earnest', 'placing the hand upon'. There are similar expressions referring to social relationships: 'my life rests in his hands', 'to offer the hand', 'to give the hand', 'He is his "right hand"'. We even find that a 'hand' is identified with a person, as in the nautical expression: 'there are seventeen hands on board'.

I should like to add that we meet such metaphorical expressions in all European languages and very probably also in non-European ones as well. A few examples may suffice: comprendre, concevoir, capable, exprimer, imprimer, conception, impression, expression.

If it should be asked why so many ideas of activity are borrowed from the vocabulary of the functions of the hand, we may answer that, as compared with the partly more developed senses (sight and sound), and partly less developed ones (taste, smell, vibration and balance), the sense of touch has precedence from the point of view of the theory of knowledge.

Katz[1] has rightly pointed out that the knowledge mediated by the sense of touch is most capable of bearing a reality character. The sense of touch carries a greater force of conviction about the reality of the external world than the other senses.

For the naive observer, the object which is touched is apparently real. A stick immersed in water appears to the eye to be broken: the hand corrects the illusion. We see objects in space larger or smaller respectively, according to our distance from the object. That is why, in optics, we speak of the apparent size of spatial objects in contrast to

[1]D. Katz, *Der Aufbau der Tastwelt*, Leipzig, 1925.

their true size. Only the impression of touch is competent to judge real, objective measurable size; this impression remains unchanged from whatever distance we have grasped the object with the grasping hand.

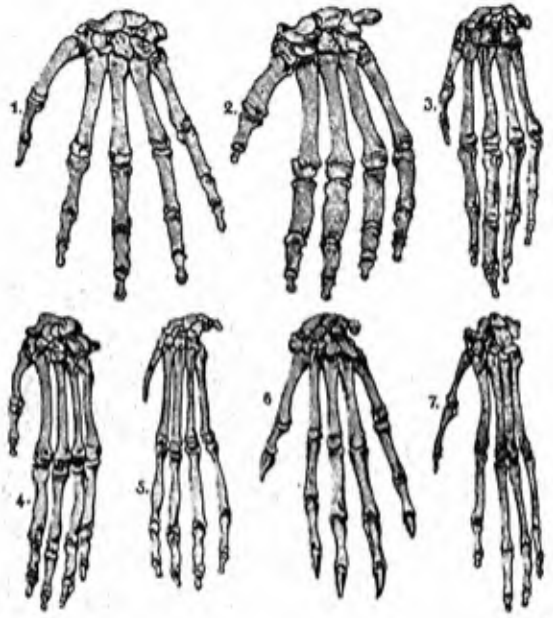
These facts led English philosophers, above all Locke and Berkeley, to believe that tactile space is the *original* space, and that visual space is derived from it. This conception in relation to the origin of visual space, is open to criticism, as I have already shown in my book quoted above.

An entirely different question, discussed in the theory of knowledge of these two philosophers, is whether we should ascribe to the organ of touch, from the point of view of its development history, precedence over the other senses, in particular, as compared with vision and hearing. What follows will be concerned with this question.

(C) THE PRIMACY OF THE SENSE OF TOUCH AND THE PLACE OF THE HAND IN THE BIOLOGICAL SYSTEM

Comparative anatomy and physiology have taught us that the more highly differentiated sense organs, like the visual and auditory sense organs, have developed from the general skin senses, in particular from the original organ of touch. Evidence for the primacy of the sense of touch is provided by those instances in which a gradual differentiation of the original organ has not taken place, instances in which because of peculiar conditions of living the animals have remained on a 'lower' level as, for example, worms living in earth holes. As a rule these organisms possess only one sense organ, outwardly characterized by touch points and touch hairs. Other instances point directly to

gradual differentiation of the visual organ from the skin sense. Indeed, there are animals that do not yet possess visual organs, only so-called eye-points, which cannot see



5 Skeletons of a human hand and of apes' hands

but are particularly sensitive to light. Furthermore the organs of taste and smell show clear traces of their origin from the skin sense.[1]

A further argument for the primacy of the sense of touch is provided by child psychology. The suckling while he is being fed has his first strong impressions in experiences of touch and smell. The oral zone, the zone of the

[1]W. Wundt, *Physiologische Psychologie*, Leipzig, 1902, p. 449, compare G. Kafka, *Einführung in die Tierpsychologie*, Leipzig, 1914, Vol. I.

mouth, plays the most significant role in the first period of the child's life, as is well known. Stern has put forward the view that the original space of the new-born is, in fact, the region of his mouth.[1] The mouth is the only organ that from the first day onwards reacts to definite impressions of touch with specific instinctive movements. In the later development of the child the uninhibited need arises to touch everything that the surroundings offer. Everything that the child sees he wants to touch. This need for touching and grasping remains in the human adult; in museums and zoos we must be reminded not to touch works of art or crocodiles. As far as the *biological* place of the hand, including the arms, is concerned we may say that the hand represents an organ which includes in itself two interrelated systems, namely, the sensory and the motor. The hand, as a sensitive apparatus, receives manifold sensory stimuli which release differentiated sensations: it yields the sensations of pressure, touch, vibration, temperature, pain, movement, localizes tactile stimuli, perceives changes of location in the hand-arm system, and takes note of the spatial quality of objects that are touched. The hand is the only organ distinguished by such manifold forms of sensation and perception. Besides having these sensitive experiences, the hand constitutes the centre of impulses of movement, of giving form, of willing, and at the same time is the executive organ of these impulses. Because of this complex function, the hand occupies a specially unique place in the biological system.[2]

[1] W. Stern, *Psychologie der frühen Kindheit*, Leipzig, 1930, p. 88.

[2] The unprecedented spread of Röntgen's discovery is bound up, in my view, with the biological meaning of the hand. Without question, the photographs of the hand which were made in the first weeks after the discovery had the effect of demonstrating the considerable qualities of Röntgen rays and of indicating their significance for the study of anatomical variations. Without the photographs of the living hand, the discovery would presumably have been confined for a time to the loneliness of the physical laboratory.

V

The Specific Functions of the Hand

(A) THE FUNCTION OF PERCEIVING AND RECOGNIZING

THE function of the hand in perceiving and recognizing or, in more general terms, the haptic sense, relates to the three features of spatial objects, namely, the object itself, its material and its form.

Recognition by means of the sense of touch is, in the first place, directed to definite qualities of the material, to its hardness, smoothness, roughness, dryness, coldness, in a word: to its surface structure.

If, with eyes closed, we let the hand glide over a piece of leather, we recognize it immediately as leather; at the same time we perceive its roughness, dryness and its temperature, that is, properties which, in a certain combination, evoke the specific impression of leather. In similar fashion, we directly recognize other materials through our sense of touch as, for example, metal, glass, wood, paper, ice, and also the various kinds of these materials. We do not have to make any special effort to sort out by tactile experience, different kinds of paper, which to the eye are barely distinguishable, and to place them in an order of roughness or thickness. It is only necessary to handle the surface of the paper carefully while making to and fro movements of the index finger or to

bring the paper to be tested between the thumb and the index finger. Researches have shown that the fingers function like precision instruments, like fine micrometers. Most observers are able to discriminate a difference in thickness of about two thousandth of a millimetre. If this incredible discriminatory sensibility of the finger is recognized, it will not surprise us to find that the blind can easily read Braille script—a script consisting of a combination of six raised points. The points of the normal script of the blind have a breadth ranging from 1·2 to 2·1 millimetres and a height of only 0·5 to 0·1 millimetres, so that the letters in comparison with the perceptible elevation of the paper appear gigantic. The extraordinary sensitivity of the organ of touch reveals itself in the testing of materials like cellulose, woven stuffs, types of wood and the like. Wool buyers can establish, by means of touch, the finest qualitative discriminations among samples offered for sale, and thus determine their value. They are as practised in tactile recognition as earlier Italian craftsmen who could choose the correct shade out of a variety of some 10,000 colour tones.

Apart from the elementary qualities of the object itself, our haptic sense can also recognize complex structures of surface or material, for example, sticky, oily, moist, wet, dry.

It is of interest to mention that the sensitivity of the fingers is not reduced if, instead of employing the actual touching surface of the finger, we use fingers covered with a colloid solution or a coating of rubber. This explains why it is that in the practice of medicine rubber fingers or rubber gloves do not in the least hamper the feeling and work of the hand.

In contrast to the sense of touch, our eye is not capable

of perceiving certain qualities of materials, particularly the last mentioned, such as sticky, oily and so on. If, however, we are successful in judging surface quality without the co-operation of impressions of touch, our judgement is mostly based on associations which we have earlier established between optical and haptic impressions. Among the exceptions belong those tactile impressions of materials which have their *correlates* in the optical sphere. The visual sphere disposes over more correlative characteristics than the haptic sphere. Thus there are optical characteristics which point to elementary phenomena of touch such as roughness or smoothness, for example, gloss. In contrast to this we cannot find in the haptic sphere any correlative characteristics for the chromatic qualities of objects or for the distribution of light.

Let us now turn to the haptic perception of objects. Recognition of things haptically is successful in part directly, in part by interpretation. Directly, as in the optical sphere, the bare hand recognizes only the things which are already familiar through daily experience. Things which are less known are not grasped and recognized at the same time in a single action. The recognition or identification of these things presupposes successive touching.

The successive process of touch represents par excellence the process of haptic identification. Successiveness plays a special role in identification by touch, not simply because large objects cannot be touched all at once, but also because movement possesses a forming and shaping power.

This successive analytic process of touch leads mostly to a piece-meal, fragmentary perception of things. From the details of which one takes cognisance in this manner the

whole can be formed step by step or suddenly in one action. In most cases, however, this synthetic process of distinguishing objects does not occur. In its place there comes a rational process which builds up the detailed touchings successively into a unified impression of an object.

The criteria of recognition in haptic perception are material, form, location, and their combinations.

Occasionally by recognizing the location of a thing we can identify the object touched. In this way, the impression of a cold, smooth and hard surface in a definite place leads to the identification of a porcelain dish; in another place, an enamel bath. Often, the identification depends on the perception of the schematic form of the object, as for example, if we are groping in the dark for a pipe or a book. If an object belongs to a familiar category, one of these criteria suffices. Once the category of an object is recognized, the process of recognition or identification by the hand is, as a rule, decisive. It is characteristic of touch that we do not strive for an exhaustive recognition of things. The identifying function of the hand directs itself not to the individual but to the general features, to the properties of the category as a whole. In distinguishing things with the hand it is a question of *what kind of* and not of *which* particular one. Generally, when the sense of vision is excluded we are concerned with identifying one object out of a definite category of objects, for example, a key or a pencil, but not to identify a definite key or a definite pencil. For the hand, the individual quality of an object is a matter of indifference on pragmatic grounds; for the sense of touch would have great difficulty in ascribing particular details to an individual object, to yield a unified impression of form. The haptic sense does not possess the

capacity for intuitive unification of the manifold. This capacity belongs in the first instance and on a large scale to the senses of sight and hearing, for which matter (colour, size, tone) and form are indivisibly bound together. This may be the basis for the fact that art in all its forms and possibilities of expression, from the most primitive beginnings to the highest flights, from raw and technically unaided naturalistic illustrations to the most artistic representations of the ideal of beauty, is based upon the *visible world* and on a fruitful imagination enriched by visible nature. It would be the simplest hypothesis to consider the first tools of mankind, above all hand-axes made with the hand as a model and various vessels of prehistoric times, as the result of *pure haptic shaping*. But even things shaped on haptic principles show, at a relatively early phase, in the Magdalenian era of diluvial times, about 20,000 years B.C., schematic engraved images and abstract drawings scratched out, characteristics which appeal to the eye, to the sense of sight. In like manner, the need to adorn the body points to the visual sense. Even among primeval plastic art forms made of clay, bone and ivory such as round figures, reliefs and other productions, which we can think of most easily in connexion with the touching hand, engravings and curved figures have been found which can be considered and formed for the eye alone and not for the hand.

Whichever way the haptical world of form is created, it cannot rival the wealth of the visual world. The function of touch is not governed by an impulse to consider art forms as such, to say nothing of creating autonomous forms of art. The enjoyment of forms of nature and art is not, by any means, in such direct relation to touch as it is to vision.

The limited importance of form in haptics is nowhere so clearly revealed as among the *blind*, for whom the perception of spatial shapes is thrown exclusively on to the function of the hand. Those who often visit institutes for the blind cannot avoid noticing what little interest the blind take in the shape of the things surrounding them. It would never, for instance, occur to a blind person to touch the objects around him. He is satisfied with a general orientation to his environment. I have frequently been together with the blind but I cannot recollect ever having observed them paying attention to the shape of things. It is worth noting that blind children must be led to touch objects. On the whole, blind children have much less contact with objects than we think they have. Most things do not attract them in the slightest and do not stir them to any activity or phantasy. This shows itself, among other ways, in the fact that they generally feel no need to handle objects of art or to receive instruction on the exact form and the tectonic texture of things. We should not be able to understand this manner of behaving on the part of the blind if form played a prominent part in the perceptual world of haptics. So it is not surprising that no proper art of the blind exists and that the blind, in so far as they concern themselves with plastic art, must of necessity be guided by thematic principles and principles of composition in plastic art. The emphasis on geometrical system in the plastic art of the blind, the tectonic constraint, the limited freedom in giving shape, the strong reliance on forms which have become typical, the curbed phantasy and the voluntary subdued possibilities of expression demonstrate convincingly the intention of the blind to follow the expressive forms of the sighted and to cling to them. That is why such a large number of works by blind plastic artists

give us the impression of having been made by sighted artists who are not technically of a high calibre.

More consideration is given to form by those who become blind and in a still higher degree by the weak-sighted; but even their interest remains within modest limits. I once knew an intellectually very lively and active blind boy who lost his vision in his ninth year as a result of an accident. In the first stages of his blindness he handled everything within reach with irresistible pressure; but in due course, the more he came to terms with his blindness the more he lost interest in the things around him.

All this becomes intelligible if we realize how hard it is to grasp form by means of the feeling hand and in what roundabout ways the sighted, like the blind, achieve it. I have discussed this problem in detail in my book *The Psychology and Art of the Blind* (1950) on the basis of theoretical analysis and experimental research. It is a question of a process which in contrast to the visual is exceedingly complex. Whereas in the optical sphere we grasp the form of an object as such in its unity and articulation in a single act without any noticeable activity on our part, in the haptic sphere we proceed stepwise. We handle the individual parts one after the other and only through consciously linking them up do we arrive gradually at unity of form. Even small objects that we can hold entirely within the hand are handled piecemeal, in successive fashion, in so far as we want to get a precise impression of them.

If a blind person comes into contact with an unknown object or if the thing that he touches departs so much from the familiar range of variation of the same kind of object that his touch-memory and his experiences of touch do not suffice for recognition, then he is driven to handle the

object from all its sides. This tendency, which manifests itself in an irresistible impulse to perceive the object in its concreteness and three-dimensionality, comes into operation in every haptic process of recognition. As our point of departure in haptic recognition, we take the plastic impression of the object. At this stage the object seems to have something of the enduring character of the external world. For this reason the blind feel discontented if they have no opportunity of touching an article on all its sides. Structural recognition of an object presupposes being orientated to its location and to the size-relationships of its parts. In contrast to touch, vision has the advantage of being able to recognize spatial relationships in a direct act of intuition, whilst the organ of touch is forced to employ a method which is not habitual in visual experience, namely, a procedure which both measures and compares. This comprehensive measuring activity justifies us in designating the haptic sense, with certain reservations, as the 'geometric' sense.

As we have already seen, successive touching is by its nature bound up with *movement*. Not simply because otherwise the fingers would not be in a position to examine larger objects but also because movement has constitutive meaning for the haptic perception of form; it is this indeed, which seems *to permit the form to emerge*. Touch without movement could scarcely arrive at a representation of form.

But even when the details have been touched the total form is not yet given. The parts which are touched must be finally unified in a total form, in a complete impression. This synthesis presupposes a specific constructive process, which we see in the visual sphere only exceptionally. The process is, however, very characteristic of haptics. Here,

thinking and phantasy exert their effects together with intuition. The parts of the figure grasped haptically become fixated abstractly, and the intuitive ideas which are awakened by these abstract fixations provide the foundation stones for the synthesis of form.

I should add that among sighted persons and among many who became blind in later life, there is a tendency to transpose haptic images into visual ones, that is to say, to visualize impressions of touch. We can form some notion of the enormous difficulties a blind person must overcome before he gets a more or less adequate image of the shape of an object.

In the haptic sphere we can distinguish three kinds of form: the haptomorph, the optomorph and the constructive.

Haptomorph form arises from resting touch, that is, when we touch the object without moving the tactile organ. We arrive at haptomorph impressions of a special kind in spontaneous movements of the limbs, when the organ of touch is excluded (walking, running, dancing, making gestures, etc). The true haptomorph forms appear only by joint operation of touch and movement. We produce such a haptic experience of form best when we finger small unknown works of plastic art after touching them unintentionally. In such purely receptive touching, even in relation to a finely-modelled statue elaborated to the last detail, there emerges only a structurely differentiated schema of the body without attention to detail or proper articulation. Purely haptomorph shape is perceived when we exclude visualization. This occurs rarely because visual images tend to appear directly and automatically thus disturbing the autonomous haptic experience of form.

In *optomorph* forms, impressions of touch, as a result of

visualization, are fused or blended with visual representations. The visualizing of haptic impressions of form extends only to detailed successively touched parts of the object. Closer examination suggests that it is not the haptic form itself but the structure known through the sense of touch which becomes transferred to the sphere of vision.

The last and at the same time the most complex kind of haptic representation of form is the *constructive* one, that is, the form in which abstract factors operate beside intuitive ones. In this case, a more or less articulated and schematic image of form is supplemented by abstract influences, giving rise to a kind of integrated image.

None of these forms built up by touch represents an individuality of form. The haptic image of form which remains schematic cannot receive that unity of shape which belongs to visual form. It is indisputable that the feeling for form belongs originally and intrinsically to the world of sight. The world of forms, its vast diversity, its wealth of relationships and its aesthetic significance only come to full consciousness in the mind of the sighted person. The haptic or touchable world also has its forms even though they are more limited and in part differently disposed. At the side of the autonomy of the visible world stands the autonomy of the touchable world, besides autonomous visual form there is an autonomous haptical form, and besides visual phantasy there is the phantasy of touch.

Our discussion of the hand's capacity for perception would remain incomplete if we omitted to mention that in haptic perception, in addition to sensations of touch and pressure, there are also vibratory sensations, which are in harmony with performances of touch.

By vibratory or oscillatory excitations we understand

those phenomenally peculiar impressions which we experience, for example, in touching a violin string or a tuning fork set in movement. It has been shown that the so-called vibratory sense is independent of the pressure sense and that in many respects it bears a closer relationship to the sense of hearing than to the sense of touch. The idea that the vibratory sense, from the point of view of evolution, represents a stage between the sense of touch and the sense of hearing rests on this basis. (Katz.) There are animals which react promptly to oscillatory stimuli even when these stimuli evoke only vibratory impressions and not acoustic ones as well.

The close relationship between the vibratory sense and the sense of hearing indicates the two-fold role of the former, first, its significance as a distance sense, and secondly, its capacity to receive acoustic stimuli in the form of vibrations. Its character as a distance sense is shown in those animals with a developed vibratory sense which are therefore able to perceive and localize events outside their bodies. Just as our vibratory impressions can give us information about earthquakes and tremors of buildings and of the air, so certain animals with a developed vibratory sense like insects, fish, and bats perceive tremors of soil, air and water. It is known that web-spinning spiders perceive by vibration when an insect falls into the net; the approach of the prey causes an atmospheric tremor which sets the spider in motion. The vibratory sense functions here in the same way as a seismograph which records tremors coming from a distance and at times also provides information about the direction of the stimulus source.

The other function of the vibratory sense—primarily located in the hand by means of which it represents the

sense of hearing—is more important for us because of its greater significance for the mental development of *deaf-mutes*. The deaf-mute pupil acquires the so-called 'articulation speech' (the inaudible spoken language of deaf-mutes) by perceiving with his one hand vibrations in the teacher's larynx when he speaks, while with the other hand he controls the imitated sound in his own larynx. If the deaf-mute finds that the impressions of both his hands agree, he knows that he has successfully imitated the sound. The understanding as well as the learning of speech can be attained with the aid of vibratory sensations. In understanding speech it is not essential to touch the speaker's larynx because speaking can also be perceived without difficulty by the middle and index fingers from the tremors of the chest cavity. This kind of comprehension of speech is particularly important for the deaf-blind (Helen Keller, Laura Bridgman, Marie Heurtin), who because of their blindness are precluded from lip-reading.

The vibratory sensations of the hand play a special part in the perception of rhythm and dynamics, thus entering into a unique relationship with music.

Helen Keller reports in her autobiography that she prefers to place her hand on the piano when it is being played.[1] She declares that she can hear 'not only each oscillation, but also the passion of the rhythm, the pulse and swell of the music'. She thought she had an experience which resembles a normal musical impression. I give a few extracts from Helen Keller's account in which she describes her musical experience while Beethoven's Ninth Symphony was being played. We are concerned here with vibratory sensations perceived through the hand, impressions which arise in relatively great diversity and in their combina-

[1]H. Keller, *The Story of my Life*, New York, 1903.

tions, alternation and repetition, yield a kind of sensory-aesthetic pleasure.

'Yesterday evening, as the family at home listened to the immortal work, I placed my hand on the receiver and clearly felt the swell. Then the cover was removed for me and I touched the membrane. How great was my astonishment when I discovered that I could not only sense every swing but also the passion of the rhythm, the pulsation and swell of the music. The flowing together of the oscillations of the different instruments delighted me. I could distinguish accurately between the cornet and the roll of the drum, the deep tone of the cellos and the singing of the violins. How pleasantly the song of the violins flowed over the deep tones of the other instruments! And as the human voice ascended, piercing the waves of harmony, I recognized it immediately. I heard the choir swell in exultation, becoming ever more ecstatic and flaring up boldly like a flame, and my heart stood still. The female voices seemed to me like an incarnation of a choir of angels as they streamed away in a harmonious flood of the purest beauty. And the great choir beat sharply against my fingers with its waves and pauses. Then the instruments and voices broke out together—an ocean of wild oscillations—and died away like the breath of the mouth, vanishing in sweet softness'.

The description is truly rapturous: experience and knowledge, truth and poetry are not separated. A verbal description should not lead us to suppose that it is invariably based on a genuinely original experience; it may be rather a mode of speech borrowed from the verbal treasury of persons who can hear and which the deaf-blind have acquired intellectually. Nevertheless it cannot be doubted that a whole gamut of moods and feelings was released

vibratorily in this artistically sensitive deaf-blind American woman which normal persons can accomplish only through the medium of visual or acoustical stimuli.

This description impressed me deeply and I was therefore very glad when the occasion presented itself to me to investigate a similar case personally.[1] A very intelligent deaf-mute, Mr. E. Sutermeister of Berne, declared that he could enjoy music in its manifold modes of expression. Music gripped him, stirred him to the depths, and he allowed no opportunity to pass which could afford him musical pleasure. In contrast to Helen Keller, Sutermeister perceived the music not through the touching hand but primarily through his resonant chest cavity. So it was possible for him to absorb orchestral and organ music through vibratory sensations and to characterize and recognize pieces of music assimilated in this way. His 'musical' experiences were not bound up with valuations of the musical works, as was the case with Helen Keller, because the music also had an affect on him when he neither knew the programme content nor the composer's name. As a mental condition for the enjoyment of music, Sutermeister referred to an inner composure. 'The music demands an undivided heart from me,' he said, 'a complete devotion; then it reveals itself to me in its full beauty'. Here there appears to be a complete agreement between us and a person who lacks hearing.

On his capacity to distinguish various kinds of music, Sutermeister expressed himself as follows: 'I can discriminate the *kind* of music very well, for example, whether it is full of content or superficial, cheerful or melancholy, thrilling or solemn, monotonous or colourful. My eye helps me very much in my musical experiences because the

[1]Musikgenuss bei Gehörlosen (with D. Katz), *Zeitschr. f. Psychol.*, 99, 1926.

movements of the conductor and the players, especially the pianist, convey to me the kind or manner of music more easily and more quickly and they prepare me better for what is to come than if I were not observing them'. Sutermeister was capable of recognizing pieces of music, even if not to the extent which he himself occasionally supposed. When the cathedral organist played the choral piece 'Grosser Gott wir loben Dich' on the organ, Sutermeister said 'that is a choral piece, lofty and very beautiful.' When the organist at my request played another melody in the rhythm of the same choral, Sutermeister explained 'this is not the same work but it is also a lofty piece of singing.' This experiment with a different melody shows that Sutermeister's general impression of a melody was not determined exclusively by the rhythm but also by other factors. Principally, we should consider variations in the intensity of the vibration sequence, the gaps which appear here and there and which are linked with the stress as well as the pitch of the tones. Just as melodies are formed out of tones with the aid of memory so memory unites the vibratory sensations into vibratory 'melodies'—if we may, for the sake of brevity, use this expression here. The description which Sutermeister gave if a work often perceived by him is in some measure identical with the experience of persons with normal hearing. We may recollect a piece of music of which only the mood as a general impression and perhaps certain details have remained, without necessarily being able to transpose the whole piece into clear tone imagery.

In general we may say that Sutermeister could follow a rhythm very well whether it was presented homophonously or polyphonously. On superficial observation, one even got the impression that he could reproduce a rhythm

quite accurately, and this is supported by the impressiveness of all his movements.

It was not hard to establish that for Sutermeister, and so for deaf-mutes in general, the most important element lies in the so-called 'musical' enjoyment of rhythm and dynamics. These not uniquely musical components of music release vasomotor effects in deaf-mutes as well as in those sound of hearing. Our body becomes so to speak retuned and variously attuned according to the rhythm and kind of music. In so far as, at a musical presentation, there arise vibratory effects together with sensations of tone, vasomotor excitations are strengthened. Presumably many vibrations can exert a direct effect even when their intensity still lies below the threshold of perceptibility. We may assume that in the case of Sutermeister it was the vasomotor effects which chiefly constituted his 'musical experience'. The part played by the chest cavity in Sutermeister's case is, in other deaf-mutes, primarily played by the hand. We may therefore say that the hand represents an intermediary which leads the vibratory impulses into the body and sets the vasomotor system in a state of excitation. In this manner the hand penetrates the vital sphere of aesthetics.

The analysis of this case has a general significance for musical theory. I have always been struck by the fact that pure sensations of tone have such great power over people, even over those who are musically rather uninstructed, that it carries them away. It is evident that the question here is not one of pure aesthetics, because aesthetic experience excludes gross outer effects of a bodily nature. In the music of primitive peoples, percussion instruments with their sharp rhythms play a far greater role than in European music, and we know what an exhilarating impetus to

movement arises from this music at the feasts of primitive peoples. In such Dionysiac music the vibratory effect can be enjoyed to the full. If we assert that this music grips and moves us deeply, that it compels in us a rhythmical movement, we must take all this much more literally than was once thought necessary. There is a direct effect of powerful vibrations on the vasomotor system of the body. In European music the secret of a well-filled mass orchestra and the effect of a voluminous organ tone rest essentially on the basis of vibratory experiences. This gives us a taste of the earthly heaviness and physical nearness of the music the sublimity of which, when released from the earth, seems to us so unearthly.

Very recently the pedagogical significance has been appreciated of evoking vibratory sensations in deaf-mutes. Within the framework of rhythmic gymnastics, movements of arms, legs, head and back are practised together with a tone sequence experienced vibratorily. These movements give much joy to the deaf-dumb child, relax his movements and release his physical inhibitions.

In attempting to give a musical education to a deaf person musically disposed, we can venture a further step. Although the deaf-mute cannot grasp the ideational content of music or what is specifically musical, he can still be very powerfully gripped by the music, as we have seen in the case of our deaf musical friend. If we wish to evoke moods in the deaf which could speed up their tempo of living and stir their world of feeling, we should expose them to music. As the rhythm and dynamic come into mutual relationship the emotional reaction may be richer or poorer. It is necessary to establish experimentally which works of music release strong and lasting emotional effects when transposed into vibratory form. The training

of deaf-mutes in rhythm and dynamic pursues, in the first instance, gymnastic, therapeutic and pedagogical aims, without, however, excluding the Dionysiac effect of music.

The hand has a much greater significance in the musical training of people who are *hard of hearing*, in so far as their condition permits of their perception of tones and tonal connexions. In principle, this group faces no technical difficulty of any special kind. The objection raised to this view that with deterioration of powers of hearing any kind of musical practice gradually becomes impossible is in contradiction with our experience. First, because the level of difficulty of hearing in most cases remains constant or does not deteriorate to such a degree that music cannot be heard. Secondly, the musically educated person who is hard of hearing does not entirely lose his musical perceptiveness even with total loss of tonal perception, if he has so far progressed in the study of music that he can master score-reading easily. This applies much more to creative musicians who suffer from a progressive auditory handicap, as is shown by the fact that the great productive activity of a few composers who were hard of hearing, continued even after complete loss of their auditory powers. The most well-known instances are Beethoven, Robert Franz and Smetana.[1]

In the year 1800, that is, in the thirtieth year of his life, Beethoven's auditory affliction began. In 1808 he already suffered from severe difficulty of hearing, and towards 1819 his auditory capacity ceased completely. We know from his conversation books that from this time onwards it was possible to communicate with him only by writing. In spite of this, from 1819 until his death in 1827, he

[1]G. Révész, *Introduction to the Psychology of Music*, London, Longmans, Green & Co., 1953; Oklahoma University Press, 1953.

created monumental works like the Missa Solemnis (1824), the last four symphonies (Numbers 5–9), and his last five string quartets (1824–6). We may add, with a certain degree of truth, that Beethoven composed the works Opus 60/65 (1808) until Opus 135, the Quartet in F Sharp, written four months before his death, during a period when he was either hard of hearing or completely deaf.

According to his own account, Robert Franz (1818–92) lost the capacity for perceiving high tones in his twenty-fourth year. His condition gradually deteriorated until, in 1871, he lost his hearing completely. His songs, without exception, were written during the period of his auditory handicap. He published about 350 songs. If we date his total deafness from the year 1871, he composed the greatest portion of his songs, which belong to the finest creations of the German literature of song, after complete failure of his powers of hearing.

Friedrich Smetana (1824–84) also became completely deaf after a period of auditory disability. He heard subjective tones; and a ringing in the ears and inner noises constantly disturbed and irritated him. This state lasted for several years, and it was in these anxious circumstances that Smetana composed his String Quartet in E Minor and a whole series of orchestral and operatic works. In a letter to Carl Stumpf he reports: 'I haven't heard a single note of all these works and yet they have lived in me and by pure imagery have awakened compassion even to tears and intoxicating delight'. Of his eight operas, on which his fame is founded, he composed five when he was totally deaf.

In the mental development of the *blind* the perceptual function of the hand also becomes specially important. As is well known, the blind read by light pressure of the tips of the index and middle fingers on Braille script. The

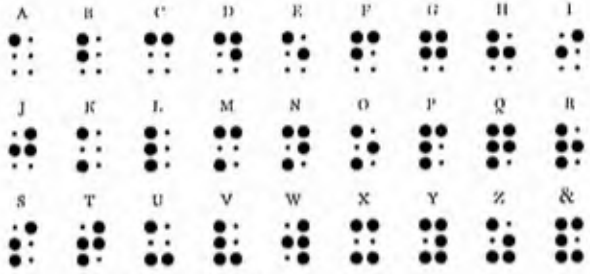
index fingers of both hands are usually used in reading.

When training of the blind was in its earliest stages, its main idea was to present the script of sighted persons in plastic form. In this way there arose the first form of script for the blind out of cursive letters fashioned in a sort of relief shape (V. Hauÿ, 1776), and in Antiqua (J. W. Klein, 1809 and P. Dufeau, 1840). The first book for the blind in relief print appeared in Paris in 1786 at the instigation of the famous founder of the Institute for Blind Children, V. Hauÿ. Experience with this script was not satisfactory for the simple reason that the perception of the forms of the letters occasioned great difficulty to the blind because of their defective capacity for apprehending form. An attempt was made to eliminate this difficulty by changing the Antiqua letters as far as possible into simple and characteristic linear shapes. (J. Gall's Runic script, 1833.) But even this simplification did not lead to the desired result. It was Charles Barbier who first recognized that the images which can be most easily and rapidly comprehended through the finger are points, not linear shapes. Guided by this idea he produced the first point script, which subsequently found a highly ingenious simplification in the hands of his blind pupil, Louis Braille, later a teacher at the Paris Institute for the Blind. Hauÿ had grasped an idea which had never occurred to anyone before and Braille discovered the most appropriate method for implementing the idea.

The *Braille point script* rests on letters formed out of a six-point field, which comprises two vertical rows, each consisting of three points.

6 The Braille point system

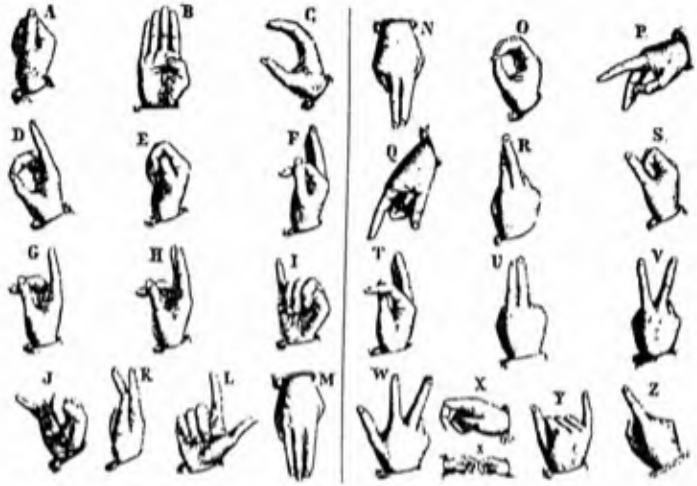
The six-point system offers the possibility of displaying all letters, characters, numerals and tones by combinations of points. The writing of the blind is the outcome of reading Braille script. With the aid of a simple apparatus the blind learn to press Braille letters on the point writing table.



7 The Braille alphabet

Just as in Braille script the hand replaces the organ of sight, so in lip-reading it represents the organ of hearing. Deaf-mutes lip-read visually, whereas the deaf-blind do so by touch, that is, directly through the hand. Lip-reading is possible because articulatory movements in speech are expressed in differentiated form by mouth movements. The movement of the back and tip of the tongue and the raising and lowering of upper and lower lip play such an important part in all articulatory movements, that the deaf-mute, by being able to combine certain movements of mouth and lip, can gather what the speaker is saying. The method of lip-reading was widespread among sighted deaf-mutes and those hard of hearing many decades ago. Nowadays it is only employed in instructing the deaf-blind. Helen Keller tells us that through tactile lip-reading she not only learned to understand the spoken word but that, in addition, it served her well while being trained in

speech. By feeling the position of the lips and mouth of her teacher when she was articulating a word, Helen Keller acquired the capacity to comprehend the words and to repeat them.



8 The finger alphabet (single-handed)

It would be appropriate in the present connexion to devote a few words to *finger language*. This is a method, by which every letter is represented by a characteristic position of the finger.

During the last century the finger alphabet was used by sighted deaf-mutes so as to understand those similarly handicapped and those with normal hearing. More recently articulatory speech has completely supplanted finger and gesture language not, in my view, with full justification. Nowadays it is used almost exclusively in training the deaf-mute-blind. The deaf-mute-blind take hold of the hand of the person with whom they are to communicate.

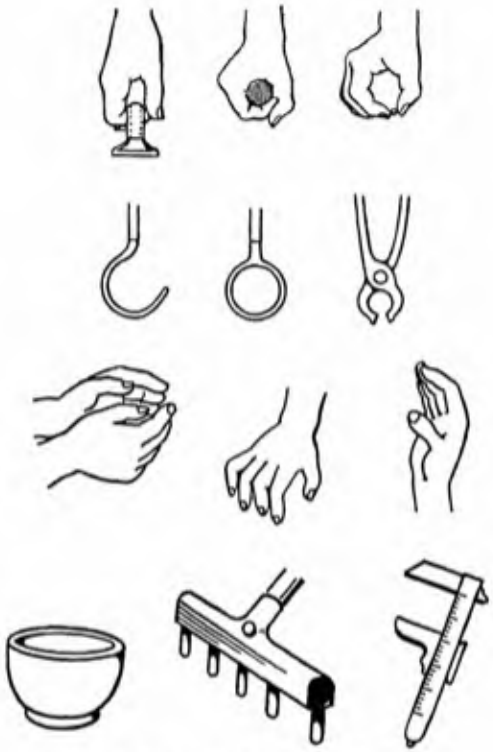
This person's hand represents letters of the alphabet. The acquisition of finger language now takes place in this way: the deaf-dumb-blind pupil is given something in one hand while the names of these objects are spelled in the other hand by means of the finger alphabet. This procedure is continued until the pupil can repeat, by himself, the groups of letters with which the individual speech forms are associated.

(B) THE WORK FUNCTION

I. Manual Skill

There is no question that the sphere which is controlled by the hand and in which the hand reaches its full power is the sphere of work. We must account for the great part played by the hand in all working activity by its instrumental character. *The hand is a universal instrument, the manifold character of which cannot be ignored.* When we realize the rich variety of working movements and working performances which the hand can carry out together with the arm and the motor system of the body, we are justified in declaring that in the activity of the hand, in the capacity for performance of this unique instrument, all that tools can achieve is potentially included. When we consider what kind of working movements the most diverse tools, implements and machines individually or in combination with one another, can execute, it seems that almost all these work processes can be rediscovered in the activity of the hand. The hand grips, pulls, pushes, presses, holds, throws, flings, tears, beats, turns, folds, ties, wraps, kneads, threads, rinses, fills, breaks, bends, puts into order. It thus carries out working movements which belong to

the most important functions of the majority of implements and tools.



9 Types of hand-grasp

We can go even further and point out that the principal tools of mankind owe their *origin* to the hand. They have come into existence by imitation and transference of the position and working movements of the human hand. Thus the hammer is a copy of the clenched fist, and the thumb, in the posture of opposition to the fingers, is a model for the tongs. The most important fist grips have prompted

the construction of different kinds of hook, ring and tongs; and the precision grip of the hand has suggested the finest precision instruments and measuring equipment.

If we take the trouble to analyse the individual functions of working machines we soon see that almost all the movements which, in combination, bring the most complex achievements to completion lead back to the simple and combined *types of hand-grip*. Experience shows that in constructing machines, certainly in most cases without being conscious of it, the point of origin is the manual grip.

How varied the movements of the hand are in a single occupation becomes clear if we analyse any handicraft into its elements. Let us take as an example the work of a locksmith. According to Giese[1] this consists of the following partial tasks:

Regular Performances		Repeated Momentary Tasks
To file	To bore	To regulate
To plane	To cut skeins	To chisel
To shave	To grind	To rivet
To saw	To countersink	To forge
To hammer	To polish or sharpen	To granulate
To solder	To weld	To burn

Taking into consideration the fact that each one of these working activities itself consists of a whole series of general and specific movements—for example, filing and welding—we can begin to form some idea of the great variety of working movements. We also recognize that in spite of ingenious technical machinery and its application in the most diverse spheres, the hand, this small instrument, far surpasses any piece of machinery.

[1]Fr. Giese, *Psychologie der Arbeitshand*, Leipzig, 1928.

The inexhaustible performances of the hand are nowhere so clearly marked as in its precision work, which has a bearing primarily on the technical aspects of art and handicraft.

It seems quite superfluous to give examples of masterly technical achievements in the *plastic arts*. Anyone who has ever taken note of the technical perfection of the hand, for example, in Celtic miniatures, Greek vase paintings, Byzantine Romanesque church vessels, or the almost microscopic elaboration of details in Flemish-Dutch paintings of the fifteenth century, knows very well that the skill of the hand, by nature and schooling, can reach a level far above that of any implement, tool or apparatus.

Arts and crafts were at first governed entirely by handwork; ceramics, the art of the gold- and silver-smith, woodcarving, hand-weaving—to mention only the oldest branches—have utilized the human hand in varied fashion and developed its versatility to a high degree.

From another aspect the precision work of the hand reveals itself in the technically perfect renderings of practised *musicians*. We get an impression of the capacity for performance of the artist's hand when we realize the dexterity of the hand in playing, for example, the last movement in Chopin's *Sonata in E Minor*, or Liszt's *Études*. This capacity for performance may be quantitatively conveyed by the fact that the maximum speed in piano-playing is twelve consecutive notes per second. Because mastery of piano-playing technique does not depend only on tempo but also on dynamic, on touch and on movement of the arm, the skill of this manual work cannot be overestimated.

We meet the same precision work in the playing of string, wind and percussion instruments. First and

foremost, we should mention playing the violin which, since Paganini, makes great demands on the violinist in the mechanics and dynamics of style of bowing and in string and bow alternation. Unfortunately, all too often, artistic virtuosity in playing the violin takes the form of artistic acrobatics; and composers since the time of Paganini are not entirely blameless for this state of affairs.

Moreover great manual skill is required by the most diverse forms of *playing* of a purely manual kind whether or not it has a sport-like character. We should include too the obvious artistic skill of the hand in billiards. Correct calculation of the linear movements of the three balls is only a theoretical requirement which has nothing to do with the player's precise bimanual performance. We need not pursue the point that in sport in all sorts of ways the hand is of primary importance. It is enough to refer to throwing the discus, fighting, boxing, ball-playing of every kind, and ancient and modern gymnastics.

We should not fail to mention the manual virtuosity in the manipulations and juggling of *conjurers* and so-called *magic artists*. We shall leave undecided the degree to which success in such artistic efforts depends on hand skill gained in adequate training and the degree to which it depends on other factors like suggestion, diversion of the spectator's attention, tricks or even things prepared beforehand; because professional conjurers, on grounds which are perfectly intelligible, wrap their proceedings in deep secrecy, rather like their colleagues the medicine men and magicians. We may add to this the fact that progressive specialization in the world of art yields new methods, which are brought to perfection only after years of effort and an incredible amount of practice and are guarded as a professional secret from others who might be concerned, and

only passed on in the family circle as a commodity not for sale. Independently of the question however whether or not conjurers, magic artists and so-called illusionists employ equipment, they display a remarkable capacity in the tempo and skill with which they make swerving, and other precise movements of the hand. To execute these manipulations in a masterly fashion requires great manual dexterity. The hand must be so thoroughly trained that the artist has all his fingers under his control. Only in this way is he able to conceal ordinary things by covering them up with the fingers which remain unmoved. He must always, by feeling alone, succeed in throwing an object from one hand to the other or to any particular place without looking at it or at his hand. In this way he is able to force the onlooker to divert his attention from the operations, and compel him to concentrate on some innocuous point (Giese). Anyone who has had the opportunity of carefully observing the tricks of a juggler brought to a level of perfection will look at the so-called materialization phenomena of spiritualists with growing scepticism.[1]

The working function of the hand is inborn in man. The same is true of the hand's level of skill. There are people who are naturally more adroit than others. This does not, of course, mean that those who are by natural disposition less dextrous cannot, by practice and habit-formation, reach an appreciably higher level of achievement. Psychotechnics, or Occupational Psychology, has set itself the task, among others, of systematically developing vocational aptitudes. Methods have been experimentally devised of raising unskilled operatives and trainees comparatively quickly to a high working standard. The goal

[1]See, in this connexion, A. Lehmann, *Aberglaube und Zauberei*, Stuttgart, 1908; and M. Dessoir, *Vom Jenseits der Seele*, Stuttgart, 1920.

here is to rationalize manual work. It is not necessary for every method employed by a worker in his job to be rationalized so as to fit his physical and mental constitution and the morphological and functional structure of his hand. Just as we rationalize the organization and administration of industry and working methods so as to arrive at better economic results with the same costs and the same working time, so we try to increase the effectiveness of the working hand by means of systematic procedures and the rational techniques of work. One of the chief problems in psychotechnics is to discover how to achieve a maximal or optimal performance with the least possible expenditure of human energy. In these endeavours, economic and social points of view are in accord with each other, because on the one hand, income is raised and on the other, the physical and mental condition of the worker is improved.

The problem of *right- and left-handedness* is linked with this problem of use of the hand.

The problem of right- and left-handedness has often been discussed by biologists and anthropologists. The greatest difference of opinion among the various writers relates to the question whether right- or left-handedness is inborn or acquired. The facts that, first, left-handedness is inherited in certain families and, second, that the proportion of left-handed persons is appreciably higher among the poorly endowed and psychopathic types than it is among normal people, among whom it varies between 4 and 8 per cent, argue against the second viewpoint.[1] A question of particular interest is whether, in constitutional left-handedness, where there is a marked inborn preference for the left hand, it serves any purpose to train the right hand to such a point that it can begin to rival the left hand. In this

[1]P. S. Parson, *Left-handedness*, 1924.

connexion we should not overlook the fact that the outcome may be the loss by the left hand of its special skill. Naturally this question does not arise in those kinds of vocation in which a high level of performance presupposes equal development of both hands (e.g. playing of instruments, acrobatics and so on).

In order to round off and complete this discussion I will refer briefly to the *pedagogic* and *therapeutic* significance of manual activity.

The recognition of the educational influence of manual activity in work led Pestalozzi, Fröbel, Decroly, M. Montessori and others to their methods of pedagogical work. Nowadays educators without exception regard manual work as a method of education of the first importance. In preparatory elementary schools, and even in secondary schools, the introduction of handiwork has achieved remarkable results. Planned handwork has also led to the best results in the education of problem children. Very favourable therapeutic effects are achieved with the feeble-minded and imbeciles by means of systematic use of the hand in working activity. Work colonies for the feeble-minded have produced large numbers of useful workers who were later able to support themselves financially either entirely or at least in part.

In neurology and psychiatry, occupational therapy is steadily increasing in importance. According to Bleuler, work with the hand is an indispensable means of training the mentally diseased.[1] Countless physicians in mental hospitals have spoken of the invaluable service rendered by manual work in the treatment of schizophrenia (H. Simon, C. Schneider, W. C. Eliasberg, St. Benedict, etc). Manual work, e.g. woodcutting and cabinet-making, has

[1]E. Bleuler, *Lehrbuch der Psychiatrie*, Berlin, 1920.

even produced good effects with patients who are seriously disturbed.

In this context I should refer to the place of the hand as an organ of touch in the practice of medicine. It is widely known that percussion and palpation belong to the most important and generally useful methods of diagnosis. Percussion takes place with the finger or with the percussion hammer. What we hear in finger-percussion and what enables us to reach conclusions in the most varied disorders of heart, spleen, stomach, kidneys, etc, is the noise made by the finger, which evokes a clearly perceptible sound, through the vibratory mass of tissue between the deep-lying organ and the percussed place. The sound images which depend on the intensity, duration, timbre and spatial extent serve as the basis for diagnosis.[1]

Finally, the therapeutic significance of the hand is expressed in *massage*. In massage a dynamic effect is exerted on definite parts of the body by means of the hand. Massage is used in rheumatism, sciatica, paralysis, weak musculature or joints, etc. It requires a very practised and sensitive hand. The masseur must be able to dispose of a wide range of movements and intensities of pressure in order to take account of the elasticity and resistance of the parts of the body concerned. Anyone familiar with the variety of types of hand grip employed in massage knows the great diversity of manipulations of pressure and movement which both hands must be capable of executing in order to attain the result therapeutically desired.

[1]We should here mention the phenomenon of the divining-rod (*virgula mercurialis*) which is allegedly also bound up with a movement impulse of the hand, evoking the impression that the rod strikes because of a 'natural sympathy' for the metal which is sought. It has long been known that a branch which is not held in the diviner's hand will not sink in the water nor be attracted to a metal or other object.

II. Human and Animal Work

We have discussed the role and significance of manual skill in all spheres of human activity. Not all of these performances are basically tied to the function of the hand. Many could be carried out without the hand. Even animals, in so far as they dispose of organs adapted for gripping, grasping, pushing or pulling, are capable of performances of this kind. Beak, mouth, snout, teeth and, above all, paws, claws and talons and sometimes even the foot, represent for them the function of the hand. In this connexion we think of the extraordinary adroitness with which dogs, cats, squirrels, mice, small bears, and even birds are able to overcome difficulties. They can, for example, by properly co-ordinated movements, remove a lid, open a door, push aside a bolt or pull a thread, so as to free themselves to reach the desired food. Take the example of the behaviour of a small brown bear while lifting the lid of a small food-box. The lid was projecting a little and the animal began raising it with his right claw. As he tried to take the food out of the box with his left claw, the lid slid off. The animal now got hold of the lid with his right claw and held it up with his arm outstretched. In this position he tried to seize the bread, whereupon the lid again slid down, until eventually at the third attempt, his efforts met with success. He lifted the lid with his right 'hand', held it firmly with outstretched arm, and in this manner succeeded in taking out the pieces of bread one after the other. McDougall[1] has described similar manipulations. His racoon succeeded in loosening a row of bolts with its snout.

[1]W. McDougall, Insight and Foresight in Various Animals, *Journ. Comp. Psychology*, 11, 1931.

It is well-known that even birds are capable of getting at hidden food with their beaks. M. Hertz's crow without effort opened a bolted food box[1] with its beak; and a goldfinch of Bierens de Haan knew how to take food out with its beak in a much more complicated way.[2] It performed the task of drinking water out of a container in which there was a thimble suspended from a piece of thread whilst, on the other side, a little food-trolley hung by a thread on an inclined plain. In order to get the food and water, the goldfinch had to pull the thread with its beak. At the same time it was forced to hold the thread firm with its foot so as to prevent it slipping back.

The special performances which the mouth, even of very primitive animals, is capable of carrying out are exemplified by weaver ants. These animals make their nests out of leaves of trees by sticking them together with the secretions of the hormones of the glands of the upper jaws of their larvae. To this end, they press the larvae, firmly held in their mandibles, against the two leaves being joined together.[3]

Animals equipped with hands display an incomparably greater capacity for performance than animals without hands; this is clearly due to their hands. Apart from small bears whose front feet, both in their form and their function, strongly remind us of the hand, it is only the apes, lower and higher alike, whose manual activity is comparable with that of man. How far their capacities extend we learn from experiments which have recently been carried out by psychologists and biologists. When we see how apes get

[1]M. Hertz, Beobachtungen an gefangenen Rabenvögeln, *Psych. Forschung*, 8, 1926.

[2]J. A. Bierens de Haan, *Die tierischen Instinkte und ihr Umbau durch Erfahrung*, Leiden, 1940.

[3]H. N. Ridley, On the habits of the Caringa, *Journ. Straits Branch Royal Asiatic Soc.*, Singapore, 1890.

hold of fruit lying outside their reach, how they are able to bring it to themselves with sticks and rakes, how they use sticks as levers to lift stones or to turn them round, with what balanced skill they use sticks for climbing so as to reach things hanging up, how, too, they can slide two short sticks into each other or pile chests one on top of the other in order to get at objects not reachable with the hand, it will not surprise us that these manipulations may be brought into close relation with those of man. What part the hand plays in these performances as a prehensile and working organ and what part is played by the higher level of intelligence of the ape is very hard to determine. The fact that small bears whose limbs could enable them to carry out the same tasks as apes are actually capable of performing them only to a very limited extent shows that the level of intelligence due to species or individual endowment is not without some influence. Moreover, the diversity and skill of the manipulations of anthropoids are greater than in lower apes. Finally, there are also great individual differences among anthropoids which are exclusively attributable to variations in endowment. At all events, it is the hand which puts apes in the position to accumulate experience, to experiment with things and to sharpen the understanding for concrete tasks. The unfolding of intelligence requires means, and the hand as the instrument of manipulation is among the very first of these.

Observation of apes given tasks for which they have neither species nor individual equipment has led animal psychologists to the view that apes, especially anthropoids, when put in a state of constraint can use objects as tools and occasionally even produce tools suitable for the need of the moment. It cannot be denied that anthropoids which

are particularly intelligent sometimes carry out manipulations which include some of the signs of the use of and production of tools. It is true that we cannot overlook these achievements without giving them the careful consideration that is their due. We are bound to face these manipulations squarely and enquire whether they may be put on the same level as the use and production of tools by man. The bare facts, indeed, favour this point of view and there is no difference of opinion on the subject among psychologists and experimental biologists. The researches of Hobhouse, Yerkes, Köhler, Klüver[1] and others demonstrate with what skill and insight apes use sticks, branches and boxes, in order to reach objects of vital significance for them. They conclude from these experiments that apes have the capacity for using things purposively, for finishing tools and for improving them.

If, with Bierens de Haan, we understand by 'use of tools' a mode of behaviour by an organism which makes possible or facilitates the attainment of a goal by means of an object not a part of its own body, in such instances we have a true utilization of tools. And if the tearing of a branch from a tree or the separating of planks or the fitting together of hollow rods suggests the essential element in tool production, it is natural to see in such activities early forms of human tool production. If we judge the manipulations of apes in this way we must also, if we are to be consistent, also regard as tools the larvae of weaver ants by pressing which they stick leaves together. The same applies to quite useless things like blades of straw, rags and anything else that apes get hold of—even live rats—if they try to attain their goal unsuccessfully. The fore-

[1]L. T. Hobhouse, *Mind in Evolution*, London, 1915; R. M. Yerkes, *The Great Apes*, New Haven, 1929; W. Köhler, *Intelligenzprüfungen an Anthropoiden*, Berlin, 1917; H. Klüver, *Behaviour Mechanisms in Monkeys*, Chicago, 1933.

going definition must accordingly apply also those 'tools' which are—as is usual—bitten or pulled to pieces by the animal and made utterly useless after a successful attempt.

If, in interpreting these performances, we wish to be independent of the arbitrariness of definitions, we must discover some other approach which is not only scientifically unobjectionable but also offers the opportunity of resolving or at least reducing the opposition of two contradictory views. For we can examine the question before us from two standpoints. On the one hand, we can place the emphasis on the *similarity* or partial accord between human and animal modes of behaviour; on the other, we can consider the *differences* between them. Our conception of the use and production of tools in the animal kingdom depends on which standpoint we choose.

We can call the first standpoint the evolutionary view, because it is more or less governed by the idea that animal modes of behaviour are to be considered as prototypes and pre-forms of human modes. From this point of departure, the achievements of the anthropoid hand stand close to the most primitive sensible manipulations of the human hand, particularly as these have preserved their original form and still belong to the most natural and biologically purposeful human manipulations. But the evolutionary problem is not thereby solved. The question remains open whether there was a period in human history during which primitive peoples confined themselves to such manipulations and methods in satisfying their material needs. Neither paleontology nor ethnography has answered this question. Meanwhile, it can scarcely be assumed that man, gifted with reason, was ever content with the unmodified means which nature provided. Accordingly, we turn to the second standpoint, that which

places principal weight on variation in means, goal and manner of work.

The oldest human tools such as natural stones, modified by human effort and used for a variety of purposes, were already known to paleolithic peoples. Against this view we can perhaps claim that prehistoric man (like primitive man) sometimes also used raw, unelaborated natural things (stones, wood, animal bones) in his work. This was presumably the case, though the reservation should be added that natural objects were used as serviceable instruments for special purposes and that, apart from these, other tools made by him were also at his disposal. Neolithic man worked, tilled the soil and made clay vessels and weapons. *Tools* in the anthropological sense only arise when an object is formed or altered with a *conscious purpose*. Occasionally an unsmoothed stone or a broken branch may have been used as a *means* of work: such things only become tools when they are elaborated or adjusted by means of some other material or implement. On this view, the emergence of a tool, even in its most primitive form, presupposes a capacity for shaping and modifying with a conscious purpose. It does not seem to me to be an exaggeration to assert that the tool as the instrument of work must itself have arisen out of work.

Furthermore, an important factor should be considered which has hitherto completely escaped attention. The sense and significance of the tool is closely connected with the tendency to its tradition and development. Paleolithic or neolithic man produced his stone tools, his chisel, hammer and axe, not simply for his own use but at the same time for the use of his dependents and his fellows. These productions of human labour were handed down from generation to generation and gradually developed to

standard form. Such a sociological influence cannot be established among apes even in a most rudimentary form. A 'tool' produced by an ape will not be taken over, still less improvised, by posterity. Each ape or group of apes must always start the production of so-called tools right from the very beginning and no progress is made. The objects are bound to the concrete situation. They lack any impulse towards stability or durability. They do not emerge from work and are without any potentiality for development. They are devoid of tradition and should not be granted the same designation that we give to the typically formed implements created by human toil which follow the course of development of civilization and are adapted to a definite purpose.

There is a further circumstance which favours our drawing a sharp dividing line between human tools and the expedients employed by the need-bound animal, namely, the fact that an unelaborated stick or unpolished stone, even when used as an implement for work, is not considered and valued by man as a tool. Man's relationship to these merely occasional 'tools' is entirely different from his relationship to instruments which were made for work from the outset. Only the latter are usually regarded as the legitimate property of man as a worker. So it is intelligible that the sole property of many peoples living under natural conditions consists of tools, hunting equipment and articles of adornment.

It is unprofitable to discuss whether the solitary example —quoted *ad nauseam*—of two bamboo sticks being joined together, should or should not be regarded as tool-making. As we have seen, such a view would depend on an initial assumption. In any case it need not surprise us to find that anthropologists do not unhesitatingly consider the

performances of chimpanzees as human tool-making. The gap between the double bamboo stick and the simplest human tool is too enormous for the former to be thought of as a stage towards the latter or to assume that human tools are derived from the primitive methods of manipulation employed by apes. Consequently we are justified in counting tool-making among the characteristic features of man.

What we have said about tools applies still more to the *method of work*. Methods of work which are modified according to actual conditions and which are adjusted to the actual working goal are not found among the higher animals. Even those investigators who believe that manually adroit chimpanzees use bamboo sticks, boxes and rope as 'tools' would hesitate to assume that these animals are capable of rational methods of work.

Tools are created by *the hand*. Only the hand that creates tools and uses implements sensibly possesses an instrumental function. The human hand is precisely an instrument of this kind, a universal instrument worthy of admiration. It became such a thing in the first place by participating in work of the most diverse kinds. However, the human hand was able to take part in work and make working implements, and use instruments sensibly, just because it became an organ of *thinking* and *speaking* man. No one has characterized the human hand better than Aristotle. In his *Metaphysics*[1] he writes: 'It is not a hand in *any* state that is a part of man, but the hand which can fulfil its work, which therefore must be alive; if it is not alive it is not a part'. The human mind first transformed the hand into an instrument; out of the original grasping hand the mind shaped a hand that works.

[1]Aristotle, *Metaphysics*, VII, 1036b30, Oxford, Clarendon Press. Transl. by W. D. Ross.

These considerations lead us to the question of the place of work: is it bound exclusively to man or may certain activities of animals also be regarded as work?

In my view work, for the same reason as the invention and use of tools, is tied to *man*. If we believed the chief characteristic of work to be creation of new products which could not have come into being without the activity invested in them, we should have to regard as work nest-building by birds, building activity of coral, cell construction of bees, the subterranean tunnelling by moles and termites, spinning by cocoons, sewing by Yucca flies, and collecting and preparing of honey by bees, and place them in the same category as human working activity. If so, we should not be regarding work as distinctive of man, nor in psychological anthropology—as Bergson[1] has done—in place of *homo sapiens* introducing the idea of *homo faber*.

It cannot be denied that the 'productive' activity of animals occasionally bears a likeness to human work. The animal, like man, produces things for satisfying its needs in a manner that serves its purpose. Animals, like human beings, build, bind, spin, collect, cleanse, and care for their young. They go into action and achieve something that nature does not give them directly. There is thus a far-reaching resemblance between them in relation to performances and the manipulations that are connected with them. But in regard to the inner character of these activities, the power which brings forth these performances, there are *unbridgeable differences*.

In contrast to human work, which executes tasks with conscious goal-setting and with the aid of means and methods made by the workers themselves or taken over from previous generations, so-called animal work is

[1]H. Bergson, *L'Évolution Créatrice*, Paris, 1910.

formed in its entire structure and course, biologically rooted in the species and subject to unchangeable biological laws. It is precluded from any measure of development. It gives the individual no freedom to set for itself any new goal of work, to discover new means or to devise new methods of work. Animal work is exclusively directed towards the primary, vital needs of the species and adapted to them. It is built into the collective organization of the animals; it constitutes an essential part of their vegetative life. Even the 'tool' with which the animal performs its productive activity is always an organ of the animal itself (beak, claws, hand, honey-bag).

The 'work' of the animal therefore belongs to the truest expressions of its life and is inseparably bound up with its very existence. The working animal *must* work in order to exist; and it can perform the 'work', exactly as it carries out the rest of its vital functions, only *in a specific way*. If it does not work, it perishes because of the omission of one of its most important biological functions. The bee does not choose its work; Nature presses it upon her. It is not left to the bee to decide whether it is inclined to exercise this species-bound activity; it has no choice. It does not learn the work, it does not imitate its older fellows; it performs its task exactly in the same way as creatures of the same kind have done for thousands of years. The small bee works with precision, with amazing exactitude; *but it cannot do otherwise.* One could even say that it is not the bee but the organs which build, control and clean the cells, care for the queen and her embryo bees, the *organs* which function in this way by nature and cannot do otherwise. The bee employs no special methods of work, because it is equipped by nature with all that is necessary. Task, work, means and method are given by nature; they are inherited.

If we characterize animal activity in this fashion, then even the finest, most accurate and 'ingenious' work of animals will no longer appear as worthy of our admiration; it is just as mysterious and enigmatic as any other physiological process, as Nature herself, no more and no less.

Characteristic of so-called animal work, in contrast to human work, is the circumstance that it is encountered exclusively among primitively organized animals, even among those at a very low level of organization, never, however, by highly organized. The most perfect examples of animal work are found among insects which, as is well known, carry out the finest, and occasionally, mathematically exact (honeycomb cells) and physically exact work (termites). Among birds, the building instinct yields much less exact work and at times it is even superficial. The lower mammals (moles and mice) work still more imprecisely, whilst the higher mammals *do no work at all*. They can only assist man in his own work, but for this they need his constant guidance and even then it is the man that works and not the animal. We are reminded by this circumstance to take note of the fact that only the animals whose existence is conditioned by a biologically organized group and, corresponding to that, by performed, unchangeable social instincts, are capable of working performances which might be compared with those of human beings.

What does this mean? It means that the more the individual animal is released from the socio-biological aggregate, the farther it moves away from the organized group, and the richer its individual experience, the less capable it is of doing work. We may assert without any hesitation that the possibility of animal work—and, *cum grano salis*, it may be added, human work as well—is in inverse relationship to the relative independence of the

individual from the group. If the individual animal is completely within its community, if it is entirely governed by the patterns of life of the species, it will carry out its work as a social organism according to a 'plan' which is preformed in its organism. On the other hand, the more developed and differentiated the individual animal to that extent it will possess a pre-formed model of work to a lesser degree. A dog or ape is so individualized that it could only be considered as carrying out work which is *free*; but the basic conditions are lacking, the conscious goal-setting, the idea of the future, perseverance, individual initiative, in short, *thinking* and *speech*. If dogs and apes could speak, they would also work: but if they worked they would no longer be dogs or apes.[1]

Thus we see that because of their more developed and individually differentiated structure, the higher animals do not have the animal form of work. But their animal nature, their incapacity for thinking and speaking, also precludes them from the characteristically human form of work. On these grounds we feel justified in saying that the invention and production of tools, like rational methods of work adapted to actual circumstances, are inseparably bound up with the human hand and human work.

If we place the characteristic features of animal and human work side by side we arrive at the following conclusion. In *animal work*, the kind of work and its method and means are all inherited. The course of work runs unalterably by a sort of compulsion. It is independent of the individuality of any single animal; it is not distinguishable by its nature from other performances of the organism. *Human work*, by contrast, is learnt, cultivated and modified

[1]G. Révész, Die menschlichen Kommunikationsformen und die sog. Tiersprache, *Royal Netherlands Academy of Science*, Amsterdam, Proceedings, Vols. 43 and 44, 1940–1.

by practice and experience, and determined by conscious goal-setting. It allows free choice, opens the way to new spheres of activity, develops new methods, reveals individual variations, is dependent on alternation of activity and rest, is governed by joy, duty and morale, and is fostered by all these influences.

(C) THE FORMATIVE FUNCTION

I. Productive, Applied and Reproductive Performances[1]

Forms of human work display great variations according as the work represents a free, unbound or a mechanical activity. From mechanical work to the highest achievements of the inspired hand there are countless imperceptible transitions, which vary partly quantitatively and partly qualitatively. It is well known that reproductive work involves no personal or creative element. The circumstance that masterly craftsmanship is sometimes attained in this form of work in no way alters its reproductive character. We cannot therefore count among creative achievements even the most beautiful Romanesque copies of Greek statues, or the vases, ornaments and furniture bearing a complete resemblance to the original in spite of the masterly elaboration of the material.

The co-operation between the reproductive function and the productive one may be observed in applied work. Applied work directs itself to the sensible use of knowledge, methods, procedures, and points of view

[1]For a consideration of the system of human work, and reproductive, interpretative and productive work in the narrower sense of the word, see my book *Talent und Genie*, Bern, 1952.

which are already familiar. Here it is a question of adapting and reforming the learnt material and experiences in respect to a defined goal. Applied work acquires a personal character, whereby it may be distinguished from reproductive work.

Transitions from work which imitates to work which transforms, are more suitably considered with the products of folk art and folk industry. The boundaries between these and creative art are easily blurred. Particularly illustrative in this respect is the rich diversity of ceramics of Cretan and Greek cultures. The fact that such ornamental and figurate wealth could have arisen in spite of strength and discipline in tectonic construction remains one of the most remarkable revelations of the way the artistic powers of the ancients collectively unfolded under strong individual direction.

From these remarks it follows, then, that it is not so easy to draw a line of demarcation between *work* and form-giving. It will depend very much on choice and subjective judgement whether or no we speak of a working performance as creative form-giving. Certainly a considerable number of activities cannot be described as creative work. Typing, transport, servicing of machines, etc., are obvious instances. In contrast to this, we can also name many activities in which it is only possible to decide to which group they belong after a careful analysis, for example, translating from foreign tongues, rendering of musical compositions, carrying out scientific work according to prescribed methods, and the like.

Here we shall confine ourselves to working procedures and performances which are closest to our problem, those in which the hand, by virtue of its instrumental and autonomous powers, gives shape to formless material, without

calling upon any means of work. We shall consider this independently of the question whether the production carries a personal-creative note or not. Our attention is directed to this kind of work, for it is precisely here that the creative form-giving power of the *bare hand* finds expression.

II. Prehistoric Productions

It is impossible to think of an age in which man was not active, when he did not create objects corresponding to his needs. In prehistory we rightly begin to speak of man as a distinctive being only when we find artefacts as well as fossil bones.

The oldest cultural period of man, the paleolithic, provides us with the first achievements of work in the form of tools.

It is interesting to point out that an unusually primitive kind of stone vessel found among these prehistoric tools is formed according to the proportion of the human hand. Length and breadth are in the ratio of 2 : 1. Both the shape

10 Mousterian hand-axe with outline of a hand

11 Painted scraper-handle from Santian

12 Neolithic axes made of stone or bone

13 Magdalenian batons

14 Female clay figure from Thracian burial mounds

and the absolute size of the hand emerge clearly in these primitive implements. If we look carefully at Illustration 10 we shall see below a curvature corresponding to the human wrist, then a gradual extension in the horizontal direction, and finally a tapering manifesting itself in an oval form. Even in the scraper painted on the wall of a cave (Illustration 11) in the upper paleolithic period, the hand appears as a model for a primitive tool.

In all the prehistoric periods of culture, which stretch over 100,000 years, we find made by and for the hand, scrapers, borers, shavers, hammers and arrowheads. The latest paleolithic, the Magdalenian, yields the first implements made of bone and horn (Illustration 12).

To illustrate these prehistoric articles, a few further tools and a picture of a baton (sign of high rank) (Illustration 13), from the neolithic period are shown in addition to those given above.[1]

It is in the late paleolithic that animal and human figures first appear.[2]

The productions shown here do not satisfy very adequately the condition laid down by us previously because the making of stone implements already presupposes in some degree certain technical means, if only stones have been shaped to a greater or less extent. If we do not wish to depart from the condition laid down above, it follows that there are only a few techniques with the bare hand which have developed uninterruptedly from the beginnings of human culture until the present, and these are weaving, embroidering and especially ceramics. Even the decorations on pots are executed first with the bare finger, and only later produced with the simplest of materials. This

[1] *Geschichte des Kunstgewerbes*, von Bossert, Berlin, I, 1928.
[2] M. Hoernes, *Urgeschichte der bildenden Kunst in Europa*, Vienna, 1915.

15 Bone comb with human and animal heads

16 Neolithic clay vessel

technique has not essentially changed from primitive times until the present day: it has remained pure handwork.

A beautiful vessel from neolithic times illustrates this original handwork[1] (Illustration 16).

[1] *Geschichte des Kunstgewerbes*, Wasmuth, Berlin, I, 1928. For further examples, see Hoernes, and Woermann's *Geschichte der Kunst*, I, 1922.

III. Plastic or Modelling Work of the Hand

The demands on the formative activity of the hand become increasingly various with the development of culture. It is in modelling with soft clay that the greatest tasks are imposed on the hand, and in obedience to aesthetic principles the hand must make human and animal shapes and ornamental designs. Availability to the sculptor of a definite model or pattern does not preclude the autonomous formative influence of his hand. As a rule, the sculptor will not and cannot slavishly reproduce the model: up to a certain point, he leaves the formative initiative of his hand to itself, and he controls it by vision and intelligence.

The autonomous, formative activity of the hand is most purely expressed in the modelling work of the blind, for the simple reason that among them, because of the lack of sight, the hand is oriented exclusively to its own formative power.

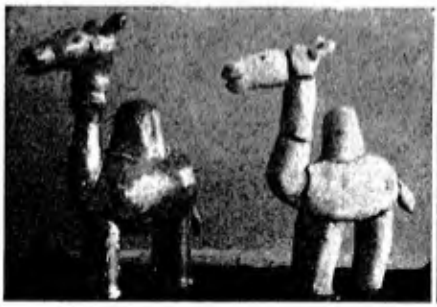
The work of blind pupils shows us that modelling is not prevented by complete lack of sight. We can find in any institute for the blind a collection of works in clay completed by blind pupils before or after courses of instruction. In general, these works do not impress us greatly, especially if we compare them with the plastic art of sighted children of the same age. From my own experience, I know that the worst representations of human beings made by unpractised, sighted children are in every respect superior to the best representations made by practised blind children.[1] A marked difference appears when we compare pupils born blind with those who become blind later. This can be demonstrated in the copy of a

[1]See the comparative researches described in my book *The Psychology and Art of the Blind*, London, Longmans, Green & Co., 1950.

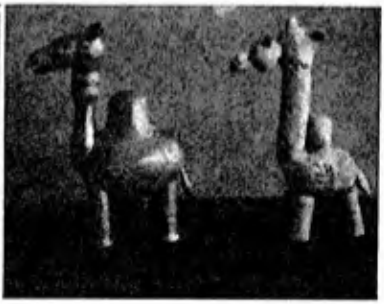
grotesque figure of a camel. (Illustrations 17 and 18.)

The formative and expression-giving function of the 'blind' hand comes to light in highest measure only in very special instances: among gifted blind youngsters, provided they model freely on the basis of their own needs without being bound to a model or task, and among artistically gifted sculptors.

The free works of plastic art of young blind persons show, with particular emphasis, the capacity for expression possessed by the hand. The link between emotion and shape-giving, which is peculiar to artistic creation, is specially striking among the blind. Experience struggling for expression and rooted in the emotions emerges stronger in the work of the congenitally blind sculptor. This is because he lacks all visual ideas of form and possesses only a limited capacity for form-perception. He is therefore compelled to shape forms more or less autonomously and in a manner which deviates from those existing in the visual world. If the congenitally blind person chooses human shapes for the plastic expression of his emotions, he will not endeavour to make copies true to



17 Copy made by a boy who became blind



18 Copy made by a boy born blind

reality, but will content himself with so-called symbolic expressions of form. Anything that is not expressible he will neglect, regardless of whether the parts concerned are relevant for form and the sense of wholeness. Indeed, expressionistic representation requires no shaping of material

19 An old man, freely modelled by a congenitally blind youth

faithful to truth. That is why the young blind modeller elaborates in the 'old man' only those characteristics like the folds on the forehead and hollows of the eyes and cheeks which are characteristic of the type 'old man'[1] (Illustration 19). The free plastic shaping of those born blind is hardly different and has no desire to be different, apart from a wish to give a symbolic-expressive representation of *their own emotions and feelings* as objectified in human figures.

[1]For further examples see L. Münz (and v. Löwenfeld) *Plastische Arbeiten Blinder*, Brünn, 1934.

The blind from birth create their shapes out of themselves, out of their own bodily emotions, as it were. Their work is an *autoplastic* representation. If the congenitally blind shapes plastically then he feels himself into that world of mood or emotion which he wishes to embody in the figure. This empathy releases bodily sensations, which work directly by giving shape through the expressive hand.

If a person born blind wishes to portray the state of paying attention, he will be assisted by the particularly intense sensations of muscular contractions and endow the forehead with deep folds. We all know from our own experience how deep and broad we think the folds of the forehead are whereas the mirror can show us how slight they really are. As the blind modeller cannot take account of visual impressions, he makes the folds too plastic and exaggerated. We can perceive this tendency in nearly all human figures which have been created by the blind. In spite of its autoplastic mode of representation, the plastic art of the congenitally blind cannot be described as naturalistic, if by 'naturalistic' we understand an imitation in the sense of optic-haptic impressions; in another sense, however, it is exaggeratedly naturalistic, for it directs itself wholly according to the sculptor's elementary bodily sensations.

The blind wish to bring their present experiences to living expression in plastic shapes, as we wish to do by expressive movements. They do not seek forms of *artistic* representations, only forms of *expression*. The free, uninhibited plastic work of the congenitally blind is not oriented towards artistic ends; indeed, it is not art in the strict sense, but plastic concretization of the content of experience. If we understand the free plastic work of the blind in this manner—and this seems to me to be the only correct way—then it is possible to grasp these forms of

expression, which seem to our own feelings so exceedingly strange.

Because the blind man *only* seeks forms of *expression*, he will strive to realize the expressive content through the simplest means at this disposal. All his resources will be placed at the service of this intention regardless of whether they are capable of achieving artistic goals. Those born blind yield themselves to the uninhibited influence of the autoplastic principle, and they do this the more so because in their plastic work neither vision nor tactile-optical experiences exercise any control.

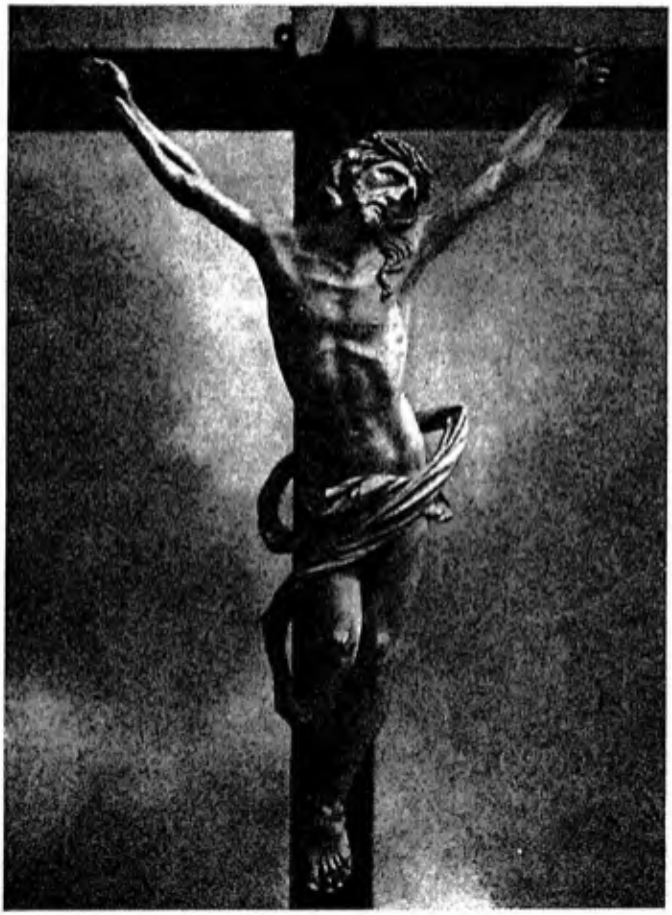
The imitative and productive work of those who *become* blind runs another course. Among these the impulse to assimilate the form of touch into the visual image makes itself felt. The experiences which the person who has become blind accumulated during his sighted period, the experiences which the eye mediated to the tactile sense during the most important years of development, which are so full of impressions, the life of ideas and dreams which takes shape under the hegemony of the visual world of appearances, the powerful system of associations which arises out of the connexion between the visible and tactile worlds of space, all these experiences, knowledge, events retain their effectiveness even after eyesight has been extinguished and especially after a strong diminution in the power of vision. Even if the abundant outward forms of visual reality gradually fade among the blind, even if they are less able, with the passage of years, to revive visual memory images, they will nevertheless, because of optically based experiences of touch, not entirely lose contact with the visual sphere.

The sculpture of a person who has become blind may be best compared with a sighted sculptor working blind-

folded. The difference between them is that while the sighted one tries to transform his visual images into haptic form, in the mind of the one who has become blind, the visual images have gradually retreated so much, that he is compelled to strive for an ever more exact copy of the model and to employ firm standards of size. That extreme assimilation to the model and technical aids finally lead to the exhaustion of artistic qualities is attributable to the hand.

Blind sculptors, however, are witnesses that the hand, in spite of complete exclusion of sight, is capable of creating works of artistic value. This artistic capacity, in my experience, refers only to those who have become blind. The Tyrolese wood-carver J. B. Kleinhans (1774–1853), often referred to in the literature on the psychology of the blind, can no longer be regarded as an artistically gifted sculptor blind from birth, according to the analysis of his works which I have carried out on the spot. It was not difficult to demonstrate that the beautiful wood carvings ascribed to the 'blind' Kleinhans could not have derived from the hand of one who was born blind. The most probable assumption is that Kleinhans did not entirely lose his powers of sight (he is alleged to have lost his vision in the fourth year of his life), so that during his activity as sculptor he could see enough to model in direct proximity. If we assume that Kleinhans was already blind in his youth, we must exclude from his works the completed works attributed to him. I would not at all dispute that Kleinhans participated in these works; he may himself have made the first construction of the body and the general outline, but the essentially artistic elements in the composition and shaping, the harmonious lines of the figures and also certain details could in no circumstances have come from the hand of a blind sculptor.

An analysis of the style of his works supports this assumption. We must completely rule out the idea that the crucifix at Brixen (Bressanone), for example, comes from the hand of a blind man (Illustration 20). Such a



20 Crucifix (wood carving modelled by the supposedly totally blind sculptor Kleinhans)

representation could not be achieved on the basis of merely fragmentary touches in a successive work-process, a feature which characterizes the sculpturing procedure of every blind person. The whole exerts its effect chiefly through qualities which may be comprehended only through the medium of the organ of sight. The form of the Holy One, while apparently at rest, is full of life and movement. There is no flatness, the whole figure releases itself in a play of light and shade. What emerges from this work and what is singularly successful in the other statues of Kleinhans, is not the haptic but the optic, not the purely plastic, but the graphic.

There is a further argument connected with this. The blind Kleinhans could not have created this image or other similar works of sculpture, because the last thing a blind sculptor could succeed in doing would be to imitate a Baroque work. The Baroque with its renunciation of calm, symmetry and balance, and above all its graphic character seeking to avoid every pressure towards a clearly defined architectonic, stands in sharpest opposition to the haptic function. Our haptic sense cannot follow the fanciful lines of the Baroque style. It seeks the organic, the constructive, the fully finished and clearly defined forms. The haptic sense is not endowed with the capacity to complement, so the Baroque principle of representation must remain foreign to it; the Baroque style is based on phantasy and mental elaboration which makes very special demands on the onlooker. The expressionistic feature of Baroque also contrasts with the haptic function. The Baroque loves artistic representation of the transitory. It seeks to take a firm hold of momentary glimpses into the flux of life. That is why it must address itself to the task of expressing passions, feelings, violent emotional agitations, in a word,

the dramatic, even if, in so doing, it must violate the laws of plastic composition. A blind sculptor cannot grasp this intensely expressionistic world, so rich in movement, even if he has the skilled hand of a master. At the place where plastically clear forms cease to exist, the blind person meets a wall; beyond this point, the organ of contact finds a world which can be *touched* but not *apprehended.*

A similar instance, familiar under the name of Cieco da Gambassi, is the artist Giovanni Gonnelli (1603–64), who was said to be totally blind. The relief work also attributed to him at Siena, Florence and the monastery of St. Vivaldo could not have come from a blind sculptor. Plastic forms of representation include just that kind of *relief* work which, in the light of sensory psychology, and in particular because of the very limited capacity for completion and illusion possessed by the process of recognition when based on impressions of touch, is in its totality accessible only to visual appreciation.

Another case which I have examined is Louis Vidal (1831–81), a pupil of the animal sculptor Barye. During his progressive blindness he faced the struggles and the difficulties which confront blind sculptors, and overcame them with industry and patience. By many years of practice he formed a rich system of associations between visual and haptic perceptions, and his skill developed whilst vision was denied him. Although Vidal always held firm to the animal types with which he was familiar, and to the naturalistic mode of representation which he had once learnt—a form of representation which makes no specially high claims to artistic form-giving—his visual imagery gradually faded and his capacities in the course of time declined.

I should like to present, as an example, a work from his first period of creative activity (Illustration 21).

It seemed to me to be out of the question that this plastic form of an animal was modelled quite independently, without any help or control from a sighted person. I have also succeeded in showing that Vidal received considerable assistance from a friend who was active as a sculptor.

An examination of the plastic art of those who have become blind, suggests that those who were sculptors before they became blind could, during the period soon after the onset of the blindness, produce works revealing aesthetic qualities. With the lapse of time, however, these

21 Great lion of Senegal, the work of Vidal, who became blind late in life

sculptors lose their artistic individuality and their works become schematic, expressionless. To the degree that the visual images and the haptic perceptions nourished by them retreat, the plastic art loses its artistic worth. The work of these sculptors rests essentially on construction, on measurement and calculation.

Only one sculptor is known to me who became blind late

in life and whose achievements are defined by principles of form which derive from the visual world. This is the blind Italian sculptor Ernesto Masuelli, who lost his eyesight in the First World War and who only decided to work as a sculptor after becoming fully blind.

Unlike other blind sculptors, Masuelli does not construct his busts part by part; he endeavours, like sighted persons, to take his point of departure from a simultaneous conception of the whole. Only when the busts have received their first form are the details filled in. Masuelli took no step nor made any alteration before he was convinced of its necessity. His modelling resembles polishing rather than bringing out form from an amorphous mass. The resulting true shape is the outcome of touching, gliding, and smoothing movements of the fingers and palm of his hand. His entire attention is directed towards the correct relationships of size and the construction of the parts.

Masuelli's artistic creativity becomes evident in the firmness with which he preserved contact with his earlier visual life. His tendency to cling to the content of a vanished world of perception—an attitude which may also be observed in musicians who have become deaf—has the effect that his spatial imagery, which originated visually, does not blend with his haptic impressions, as is generally the case with the blind. He owes it to living contact with the world of the sighted to be able to model without previously feeling the original model, and that is why movement in visual form plays such a great role in his plastic art. Through this 'visual-motor' attitude, Masuelli avoids the greatest danger which threatens the blind, the danger of destroying the unity of the work and its aesthetic effect through all too naturalistic rendering of details. He is certainly not conscious of this contact. He intended rather to

have rebuilt his new life from its foundations out of the new situation. In his reports, this conception comes clearly to light. He declared to me that he never had visual images of his work either before or after they were executed. Nevertheless I believe we may assume that in his case the *visual sphere*—which means something more and different from memory images of the visible world, namely the essence of earlier visual experiences and residues—continues to exert its influence. The continuity between his sighted and his blind life was never interrupted. His manner of work, and above all its unified character, furnishes proof of this.

Masuelli's method of representation is characterized by the fact that his forms of expression are not defined by so-called autoplastic tendencies, like those of pupils at institutes for the blind, but by *principles of form* deriving from the optical world. It is true that Masuelli's sculpture, freely executed, without an original and without a model, calls for the autoplastic attitude, but he does not, like blind pupils, allow it to rule uncurbed; he constrains it and allows it to become manifest only within the limits of fashioning. This resistance, which balances the purely autoplastic and artistic representation, is brought about partly by Masuelli's artistic nature, but partly through the participation of the visual sphere, a factor which does not play any part in the work of those born blind.

Whatever aesthetic judgement we pass on Masuelli's works, whether we recognize in them the expression of a true artistic phantasy and a deep-feeling individuality, one thing is unquestionable, namely, that we are in the presence of work which carries an artistic idea and is endowed with form by methods of the artist. Masuelli's busts do not represent copies of objects which have been manipulated;

they are the free discovery of an artist and worthy objects of aesthetic esteem.

I should like to present one example only of Masuelli's works, a girl's head, modelled out of his free phantasy in Rome without an original, under my constant observation. (Illustration 22.) He has produced sculptures more beautiful still, but I give this work by preference because it was made without any aid from a sighted person.

22 Head of a girl, freely modelled by Masuelli

The bust moves out of the pure sensory sphere and penetrates that ideal world where things acquire their aesthetic content by their specifically artistic effect. There can be no doubt that the enjoyment of this relatively very rapidly produced sculpture rests on the *aesthetic* worth of

the bust and not on our admiration for the sculpture of a *blind* person.

Masuelli's sculpture shows that provided there is a favourable constellation of factors the blind sculptor possesses in his hand an instrument which enables him, without visual control, to create plastic works of artistic value.

(D) THE EXPRESSIVE FUNCTION OF THE HAND

I. The Physiognomy of the Hand

In everyday life we often have the experience that our general impression of a hand specifically characterizes individuals and groups alike (peoples, races, and social and occupational groups). This general impression of the hand is determined by its shape, by the relative size of the fingers and by their relationship to the palm, by the tissues as well as by the skin, folds, lines and colour of the hand. This observation presumably prompted people to dare a further step and to draw conclusions about a person's character from the outer quality of his hand. We are here concerned with *physiognomic* signs of the hand, that is, with *constant* and *enduring* features, in contrast to its transitory, passing, and gestural movements.

It is generally believed that, as a basis for forming a judgement about a person, his facial physiognomy is a less reliable point of support than its expressiveness. We shall not examine here how far this opinion accords with experience; but at least its correctness is indicated by the circumstance that the most well-known investigators who have made a special study of expressive functions of the

body as, for example, Darwin[1] and Piderit[2] placed much greater weight on mimic and pantomimic movements than on physiognomy. The physiognomic features of man and animal have been derived directly from their mime in that physiognomic expression is regarded as an exteriorization of mime fixed by habit.[3] At the same time, the symptomatological value of physiognomy should not be disputed, even if no one nowadays is so credulous as to ascribe to the physiognomy of the face such great significance as was given to it in the first half of the nineteenth century when Lavater[4] was still accepted as an authority.

Scientifically-minded physiognomists did not at first display any interest in the physiognomy of the hand. And yet no one could doubt that there existed a definite relationship between the form and shape of the hand, on the one hand, and human personality, on the other, even if this correlation is not invariably expressed and, indeed, does not always hold good.

People who have the habit of repeatedly scrutinizing the hands of their fellows arrive at consistent conclusions about the relationship between hand and character. Indeed, the correspondence between mind and hand often compels us to assume a systematic relationship between them. It always seems inconsistent to us if a person highly endowed mentally or morally, possesses expressionless, undifferentiated hands and, the other way round, if a person, low on the mental or moral scale is equipped with finely-structured hands. When we encounter such contradictory phenomena we try to trace the disharmony to hereditary factors. An interpretation in terms of genetics will not, however,

[1]C. Darwin, *The Expression of the Emotions in Man and Animals*, London, 1872.
[2]Th. Piderit, *Mimik und Physiognomik*, Detmold, 1886.
[3]Brillat-Savarin, *The Physiology of Taste*.
[4]J. C. Lavater, *Physiognomische Fragmente*, 1775, and *L'art de connaître les hommes par la physionomie*, 1806.

enable such cases to be explained except instances of close in-breeding. This is shown, among other things, in the striking individual differences between the hands of brothers and sisters. Only in uniovular or identical twins do we find clear concordance between the corresponding right and left hands in the shape and lines, and in the pattern of papillaries. A pure mirror-image symmetry, however, is not even found in these. It seems to me more accurate to say that hereditary factors only give the hand its gross outlines; its finer qualities of shape derive from the individual himself. On this view, individual development should also have a modifying influence on the quality of the hand. But we have not yet gathered any empirical material free from objection, in support of this assumption, although this could be done without difficulty. We only need compare photographs taken from various stages of development with characterological features at the same period.

The findings of Kretschmer have recently given the physiognomic study of the hand a new aspect.[1] Comparative researches have shown that in extreme examples of Kretschmerian constitutional types, we can note quite specific relationships between the arm and hand in respect of shape and size. Among leptosomatic, athletic and pyknic bodily types there are typical hand shapes of the hand expressed in the index:

$$J = \frac{\text{Length of forearm} \times \text{hand length} \times 100}{\text{Circumference of forearm} \times \text{hand circumference}}$$

The structural principle of the bodily constitution is said to be revealed in the hands. In view of the fact that, according to Kretschmer, there is a rather close correlation between physical constitution and mental habitus it was

[1] E. Kretschmer, *Körperbau und Charakter*, Berlin, 1922.

assumed that the hand, which is also part of the physical constitution, should possess a similar relationship with the mental quality of the individual as the bodily structure in general. Friedemann claimed to have provided proof that the Kretschmerian athletic, asthenic and pyknic physical types and the clinical groups or dispositions to sickness correlated with them, may also be established with reference to the hands of the patients.[1] Strikingly gross anomalies of the hand can never be taken as sure signs of mental sickness. Certain peculiarities of the hand, however, indicate with a high degree of probability, a disposition to schizophrenia or manic depression. Even among normals Friedemann found a correlation between the quality of the hand and mental type. Thus a soft hand, for instance, is said to be 'always' the physical expression of an anxious, fearful person or at least one disposed to hypochondria. The state of the skin of the hand is also said to provide a noteworthy index for judging states of mood.

These researches lead us to *chirognomy*.

In order to investigate the relation between hand and character, we have to pursue the study of chirognomy (chirology). Chirognomy must be distinguished from chiromancy, which is neither scientific nor empirically based. Chiromancy claims to be able to establish or interpret a person's past, his state of health, and his character and fate from the morphological structure of the hand and, above all from the lines, elevations and depressions of the palm. Every main line of the hand is said to have its significance; one indicates length and periods of life, another indicates conjugal felicity and domestic relationships, a third, general state of health and sickness.

[1]A. Friedemann, Handbau und Psychose, *Archiv. f. Psychiat.*, 82, 1928, and Handbau und Charakterkunde, *Jahrb. d. Charakterologie*, 6, 1929.

The rejection of chirognomy by the world of learning, is due, in my view, to the fact that most practising chirologists cannot resist giving their suppositions about the past and future of the individual. They are mostly not conscious themselves that their interpretations do not follow from the analysis of the shape and physiognomy of the hand, but represent conclusions drawn from complexes of more or less reliable data and observations which lie outside the competence of the art of palm-reading.

Interest in the problems of chirognomy was already stirred in the sixteenth and seventeenth centuries, but it was first d'Arpentigny[1] and Carus[2] and later Vaschide[3] who endeavoured to provide chirognomy with a scientific foundation. They set themselves the task of establishing a typology for the expressiveness of the hand. In this way Carus arrived at four basic types, the elementary, the motor, the sensible, and the psychic. These agree well with the six types of d'Arpentigny (elementary, working, artistic, practical, philosophical, and psychic). Although these investigators tell us much that is fantastic about the hand—chiefly d'Arpentigny, under the influence of Lavater —their works are still worth reading because of the wealth of their experiences.

Of late years there has been a revival of interest in chirognomy. It is easy, in extreme cases to establish the general character of hands, as in the hands shown here (Illustrations 23 to 25). But it is very questionable whether the characteristics derived from the lines of the hand are, in fact, correct.[4]

[1]St. d'Arpentigny, *La Chirognomie ou l'art de reconnaître la tendance de l'intelligence d'après les formes de la main*, 1843.

[2]C. G. Carus, *Über Grund und Bedeutung der verschiedenen Formen der Hand*, 1846.

[3]L. Vaschide, *Essais sur la psychologie de la main*, Paris, 1909.

[4]N. Jaquin, *The Hand of Man*, London, 1933. Jacquin has the following to say about the hands shown here:

23 Criminal type

24 Volitional type

25 Intellectual type

Recently, Charlotte Wolff, in her book *The Human Hand* (London, Methuen), attempted to support the experiences of chirognomists by systematic observations and statistical analysis of her data. She is convinced that by introducing exact methods definite interrelationships could be established between hand-form and hand-lines, on the one side, and types of character and specific patterns of illness, on the other.

Ill. 23: A criminal type. This hand shows marked abnormalities. These are indicated by the apparently contradictory markings shown. The downward curve of the Head line shows vivid imagination. The short brute-like fingers compare with those of the Gorilla. The thumb is abnormally thick and heavy, indicating a brute-like obstinacy. The Heart line is straight, indicating a mental type of sexuality, which on a hand of this kind possesses a brutal quality. The Girdle of Venus accentuates the bestial tendencies. This hand betrays marked Sadistic proclivities.

Ill. 24: Enormous will-power. Where the Head and Heart lines form one deep crease across the centre of the palm it is an indication of the ability of the subject to display enormous tenacity of purpose, which, in a good hand, is an excellent marking to possess, but in a hand betraying evil traits becomes dangerous.

Ill. 25: The left hand of the late Earl of Birkenhead. The thumb is well shaped and intelligent, tending at its top joint to be slightly supple, proving an element of impulsiveness. The little finger is abnormally long, betraying his abilities as an orator. The impulsiveness shown in the thumb, plus this conversational fluency, produces a ready wit. The outer edge of the hand is straight, showing practical, logical, reasoning ability. It is interesting to observe how the Life line gradually fades away to indicate the failure of the vital forces of the body.

In this context I should like to mention that not only the hand but the *skin* as well and specially the skin of the hand and fingers has been credited with an expressive value. The differentiation of the surface structure and the outer appearance of the skin led Eckstein to the idea that this differentiation not only endowed it with a characterological meaning but also gave it a prognostic value. He points to pictures of the skin designated as clear or vague, as soft or hard, bitter or sweet, etc. According to him the general picture revealed by the surface of the skin constitutes a table of runes in which inner fate and personal history are both engraved. Kretschmer also seems to recognize the characterological significance of skin structure in that he derives from skin habitually reddened a strong temperament together with love, goodness and warmth.

II. Miming Function of the Hand

Underlying all modes of human response are mental excitations. This is as true of the movement of the body as a whole as of the individual parts, the face, the back, the arms and the hands. Every play of feature, every gesture, indeed almost every movement and posture of the body bring something psychical to expression. Mutual understanding between people rests on a systematic relationship between mental states and forms of expression. From this point of view, speaking aloud is a form of expressive movement, for in the articulation, rhythm, degree of intensity, and tempo of speech the psychical emerges in direct fashion and often unnoticed and undesired.

Facial, hand and *arm mime* and, indeed, the mime of the entire body, pantomime, are based on this reciprocal rela-

tionship between psychical states and expressive movement.

As a rule, movements of mime and pantomime are original, direct, physical consequences of transitory psychical states. They are to a large extent inborn, but partly they are acquired. As already mentioned, the lively miming modes of expression provide a more reliable support for intuitive and clear comprehension of states of mood, attitudes, and will and also for certain personal qualities, than fixed, physiognomic traits. This probably explains why it is that since the middle of the nineteenth century more interest has been shown in the study of the play of the features and of expressive movements in general than in physiognomy. After the preliminary studies of the well-known painter Le Brun, Bell, Duchenne, Gratiolet, Piderit and Darwin rightly found the highest appreciation.[1] These and later works on expressive movements have been restricted almost exclusively to the face, and only exceptionally rarely have they considered the emotional states of accompanying gestures, although in the mutual understanding of people, no less significance belongs to them than to the miming of the face.

The range of hand miming is very great; individually, however, it has little variety. There are movement-signs which are in large part original but partly symbolic and borrowed from the environment. They can be easily understood by anybody. For example, in expressing sympathy we bend the arms forward while at the same time slowly opening the hands with a certain gracefulness. This senti-

[1]Le Brun, *Conférences sur l'expression de différents caractères de passion*, 1667; Charles Bell, *The Anatomy and Philosophy of Expression*, 1806; Duchenne, *Mécanisme de la physionomie humaine*, 1862; P. Gratiolet *De la physionomie et des mouvements d'expression*, 1865; Piderit *Wissenschaftliches System der Mimik und Physiognomik*, 1867; Charles Darwin, *The Expression of the Emotions in Man and Animals*, 1872.

ment is more pronounced and more intimate in caressing with the hands, in hand pressures, and in embraces. Holding oneself at a distance is represented by a warding-off movement of the arms and hands. The hand can also express in miming suffering, fear, anxiety, anger, disdain and contempt; and occasionally more clearly and more adequately than in uttered speech which rather lacks feeling.

Thus the scientific investigation of the expressive function of the hand was totally neglected until the beginning of this century. It was only the instruction of deaf-mutes and the study of the gesture languages of primitive peoples which directed attention to the expressive function of the hand.[1]

III. The Handshake

In treating the expressive movements of the hand little attention is generally paid to the handshake, although this manifestation of our psychical life has a universally great social significance in our culture. I should therefore like to devote a few thoughts to this particularly intriguing problem.

However undifferentiated the handshake may appear to an onlooker, as soon as we begin to consider its origin from the standpoint of motives, it displays considerable variety. There are countless occasions in social life which move people to this special kind of action. The most well known are the situations in which, by force of habit, we touch or

[1]J. Mallery, *Sign Language among North American Indians*, 1881; W. Wundt, *Die Sprache*, 1900; E. Cuyer, *La Mimique*, 1902; L. Lévy-Bruhl, *Les Fonctions mentales dans les sociétés inférieurs*, 1922 and *La Mentalité primitive*, 1925; P. Hirsch, *Die Gebärdensprache des Hörenden und ihre Stellung zur Lautsprache*, 1923; P. Schumann, *Handbuch des Taubstummenwesens*, 1929; Fr. Kainz, *Psychologie der Sprache*, II, 1943.

press the hand of a fellow. Here we must distinguish between the handshake which is not followed by the slightest consequence and one which imposes on us obligations and sometimes even far-reaching tasks with implications beyond the individuals directly involved. To the first group belong those contacts of the hand that we can observe when two acquaintances meet or when someone is introduced to a stranger; and to the second group, those with which we solemnly reinforce a vow or oath. In the latter case, a verbal promise is confirmed by a motor act indicating mutual agreement. The importance and unequivocalness of this action is brought to expression by the strength of the handshake, whereas in greeting a clasp of the hand without any particular pressure suits the purpose. Besides this traditional form of handshake there are a great number of other kinds the expressive form of which depends on the intentions and state of emotion and mood and, to no less extent, on the mutual relationships of the two persons concerned. If we wish to mark our inner friendship with a handshake this will differ strikingly from the conventional handshake in strength, duration, flexibility and vibration.

Words can scarcely describe the manifold forms of expressive movements that can be assumed by the hands of lovers. Pleasure, pain, hope and doubt, which the handshake expresses with unmistakable clearness may be to some extent intimated by proverbs and parables, but hardly through the medium of poetic language. Even great poets have only been able in some degree to represent the moods arising from a handshake, though not, however, the play of the hands which acquires a dynamic pattern of a special kind with every variation in psychical impulses.

The variety of forms of the handshake depends, on the one hand, on the persons concerned and, on the other, on

the cultural group to which they belong. There are people who, because of mental undifferentiation or inhibitions which have a disturbing influence on their entire psychomotor equipment, are quite incapable of expressing their intentions, emotions or aims by means of a handshake. They are not able to support their miming and pantomiming expressions with a suitably corresponding handshake. The handshake of such a person reveals nothing; it is limp and often strikes us as unpleasant. We feel no contact with him; no 'psychic fluid' streams from his hand capable of releasing in us a friendly reaction. We have an irresistible inclination to reject this sort of soulless bodily contact.

It is entirely different with peoples among whom the handshake is either wholly lacking or restricted to a small number of traditional actions. In England, for example, and still more so in the United States, the handshake does not belong to conventional forms of greeting; that is why the handshake in these countries does not appear so differentiated as among people on the Continent. Among Moslem peoples no bodily contact is made in greeting another person. If a European extends his hand to an Arab the latter, if unfamiliar with European forms of politeness, will not know how to respond to such a 'manipulation'. If he relies on his inner impulse, he will look directly at the outstretched hand and reply to this mark of respect with a similar one of his own. European forms of greeting, in so far as they are bound up with physical contact, always remain strange to him and they have no access to his inner life.

We have a similar experience if we visit a country where men embrace each other twice on meeting or where, as was the custom in Russia, they kiss each other on both

cheeks. We find this particularly peculiar, but we do not find it so if our women-folk kiss each other on meeting or parting. Anyone taking the trouble to accommodate himself, out of politeness, to forms of greeting of foreign peoples is likely to provoke some comic situations. Something of this kind happened to a friend of my youth. He went to England as a young doctor to continue his studies. In Liverpool he went to see a distinguished old lady who let rooms to students and, in Hungarian fashion, he kissed the lady's hand. The old lady, in the belief that this form of greeting was the only one in the native land of her prospective tenant, grasped my friend's hand with a bright ingenuousness and kissed it in similar fashion!

The handshake is a symbolic manipulation. Originally it expressed mutual trust. This two-fold attitude is embodied in the fact that both persons place themselves in a highly dangerous situation, for while they grasp hands, their most natural weapon of defence and attack, namely the right hand, is out of action. Apart from this negative aspect, however, there is also a positive one in that, under these conditions, we expect support and protection from the other person; indeed we claim it, like small children grasping their parents' hands when in the street or in strange surroundings so as to be able to defy any danger. The same feeling of security is symbolized by the handshake. Consequently, it is considered disloyalty and contemptible faithlessness if a promise sanctioned with a handshake is not honoured, even if the two persons were outspoken enemies before the friendly 'manipulation'.

Whilst this handshake points to equivalence of worth and rights, the handkiss is connected with an inner attitude of subordinacy and obedience. It is true that the handkiss also constitutes bodily contact between two persons, but

only one person plays an active part, the other one being merely passive. A woman gives her hand to a man to kiss devotedly. The same applies to dignitaries of the church who, while performing their religious functions, receive a handkiss from their followers. In this instance there is no question of equivalence of worth, the passive one does not take on any obligations and need feel no affection for the person kissing his hand. The one being honoured only allows the others to express their devotion and trust by a humble 'manipulation'. This one-sided relationship gives the handkiss a specific character and distinguishes it essentially from the handshake.

The more social forms are stabilized and the more personal security is assured by laws and similar measures, the more modes of conduct which were once of great importance lose their original significance. Gradually they take on a polite character and lose their power of conviction and sense of mutual obligation. How far deep-seated 'manipulations' can be torn from their living source and continue to survive only in their external forms, is clearly shown by traditional congratulations. Not infrequently, the person being congratulated does not even know a large number of those who congratulate him. Here also there is no two-sided relationship.

The handshake preserves and will always keep its original meaning as an expression of love, affection and friendship. The problem of love in the general sense, that is, the relationship of love between man and woman, could only be discussed if we were able to describe in poetic prose two persons in love and mutually absorbed in each other. I am not, however, a poet and as a psychologist I dare not step beyond experience into loftier regions. So the representation of tenderness which expresses itself in

such a variety of ways in the handshake of lovers and in the caressing of hands remains barred to psychology. The ban would be complete if representational art were not able to express in symbolic form the full content of a mood of a handshake in warm and secret caresses of the hands.

26 Rembrandt, *The Jewish Bride*

The great painter Rembrandt was most successful in bringing to expression the significance and dignity of the meeting of hands of two lovers. The portrait in the Rijksmuseum at Amsterdam of Rembrandt's son Titus and his young wife Magdalene van Loo (the so-called Jewish bride) represents in unsurpassed manner spiritual and physical love by the innocent and yet deeply felt joining of the hands. In this picture the painter has conjured up on the canvas a whole dream world with all its tranquil bliss.

A spiritual depth and calm dwell in the beautiful hands touching each other. Not only the holiness of the moment radiates from the picture, but also the compassion and human greatness of the master. The inner life of the 'besouled' hands reveals itself in the tender and loving touch of the woman's breast where Titus feels her heart beating, in the embarrassment in the faces of both in the solemn stillness which governs the picture, in the sublimation of the sensuous, and in the expectation of a new world which would unlock something not yet experienced. The transparency of characteristic being and becoming is uttered by this picture whereby the expressive hands appear in the guise of a universal language of all human kind.

IV. Expressive Movements and Gestures

Ideas of expressive movement and gesture are very often confused with each other because they both fall under the general concept of miming. In order to remove the obscurities which have arisen as a result of identifying these two ideas, we must undertake to distinguish clearly between expressive movement and gestures.

Expressive movements occur when definite movements of the body and responses by sound release, in reflex manner, processes of pleasure and un-pleasure, for example, if a headache prompts a hand movement on the forehead or if a pungent smell leads to an instinctive movement towards the nostrils. The situation is similar when we open our eyes wide at an unexpected event, raise the upper lip and the wings of the nose in rage, contract certain muscles and utter noises in fright. These reactions of movement and sound, looked at from a purely biological point of view,

are simply bodily expressions of psycho-physiological processes. That they can also have teleological significance, for example, striking terror in an enemy and thus keeping him at a distance or awakening a willingness to help, has nothing to do with the difference between expression and gestures. Special attention must be called to the fact that expressive movements as such are not innately *directed*, and certainly *not intended*. Above all, however, they do not serve the purpose of bringing about an interpersonal relationship between people. If, for example, a child, while taking some unsavoury food, makes a miming movement with the mouth and a warding-off reaction with the hand, this whole complex of expressive movements merely represents immediate physical feelings of un-pleasure. If this behaviour of the child causes the mother to rush to help, the mother's response rests exclusively on her experience and readiness to help. It becomes something different, however, when the child gradually acquires the experience that his expressive behaviour is able to evoke the mother's interest. This individual experience will move the child to express this same mime on other occasions, but now with the *intention* of drawing the mother's attention to himself and to compel the desired handling. It is only in this instance that the bare miming movement goes over into gestures.

I would therefore speak of gestures only when miming and pantomiming movements—to which the expressive movements of the arm and hand belong—are carried out with the aim of achieving *mutual contact* and *intentional co-operation* with another person. Gestures are therefore distinguished by specially characteristic signs, and they are sharply differentiated by their bearing on speech from simple expressions of movement. Most gestures have

linguistically expressive value. So it is futile to seek for gestures anywhere in the animal world; even in the child, the first forms of gesture, pointing or showing (indicative gestures), appear only during the phase of early speech development.

Showing or indicating an object or a person with the index-finger is, in my view, man's earliest expressive gesture. In systematic observation of children from their first year of life onwards, no other gesture, in the strict sense of the word, struck me earlier than showing and pointing gestures. One of my students who investigated this problem never observed a child, who had no understanding of speech, carry out pointing or showing movements.[1] This explains why gestures make their appearance at a relatively late stage, in the second year of life, whilst miming expressions may already be detected in the first year of life.

If we wish to classify the gestures of the hand according to outer signs, we shall find a useful principle of classification in the state and position of hand and fingers. From this standpoint we can distinguish three classes of gestures:

1. Gestures which are carried out with fingers held together, the hand being either open or clenched.
2. Gestures which are expressed by fingers spread out and separated from one another, with open or closed hand, and
3. Gestures characterized by placing the hand on a definite part of the body (stomach, chest, head).

As instances of the first class we can cite gestures of begging or asking for a tip or a threatening fist (Illustra-

[1]R. Vuyk, Wijzen en spreken, *Nederl. Tijdschr. voor Wijsbegeerte en Psychologie*, 1940.

tion 27). In the second class there are, among others, the gestures which are made when expressing admiration or surprise (Illustration 28) or when we wish to explain

27 Threatening gesture

28 Gesture of surprise

29 Gesture of conviction

something or to convince someone (Illustration 29); and, as exemplifying the third class, when the crossed hands lie on the stomach to express resignation.[1]

It is particularly characteristic for the fine differentiation of gestures as well as for the unequivocalness of their interpretation that a small variation in the posture of hand or finger is enough to give the gesture quite another meaning. We only need to turn the right hand a little to the right in order to change an indicating posture into a threatening one.

30 Because of a slight change in the posture of the hand, the first expression alters into a threat

[1]E. Cuyer, *La Mimique*, Paris, 1902.

Natural gestures mostly appear in connexion with miming movements of the face and head. This seems self-evident if we realize that the miming centre of man (and, according to Darwin, of animals as well) is the face, chiefly the region of the mouth and the forehead.[1]

Natural gestures appear among all peoples and groups. Primitive peoples, like those of a higher culture, children and adults, the deaf and those whose hearing is sound, all express in gestures their moods and feelings, their desires and wishes and, on the whole, in much the same way. Natural gestures are so unequivocal and so closely tied to man's biological nature that they require no interpretation, they are understood directly. For this reason, we can make ourselves promptly intelligible by sound and gesture to people who speak a language foreign to us.

Forms of expression which manifest themselves in handwriting may be regarded as a special kind of natural and unintended gesture. As is well known, *graphology* concerns itself with the analysis and meaning of handwriting (Michon, Crépieux-Jamin, Preyer, and recently Klages, Saudek, Pulver, Jacoby). It will be sufficient here to mention that graphology as such (not, indeed, every graphologist) on the basis of exact analysis of individual handwriting, and taking due care in interpretation, is able to identify specific features of the personality with a high degree of reliability. For example, such characteristics as power of resistance, firmness, resoluteness, perseverance, and even a compassionate disposition and indifference are deduced from the regularity and general character (*Formniveau*, Klages) of the script. Which of these qualities is attributed to the writer depends on factors which may partly be read directly from the script and partly perceived

[1]Sante de Sanctis, *Die Mimik des Denkens*, Leipzig, 1906.

intuitively. When we consider how swiftly the hand responds to inner excitations and with what delicacy of feeling it can, for example, transmit the feeling-tone of a musical composition to an instrument, it need not seem surprising that handwriting possesses a psycho-diagnostic value, which can only be employed, however, in conjunction with other psychological techniques of diagnosis.

How far individual graphological statements suffice to give a general picture, a comprehensive character sketch of the person being examined and how far the competence of graphology extends, are questions which have not yet found a final solution. Graphology enters into our problem only because of its relation to the action-movements of the hand. In this connexion, graphology shows that in judging temperament, character and intelligence, man possesses in the hand a valuable source of information.

V. Gesture Language

The Speech Function of the Hand

Although manual gestures, because they are intuitively evident, direct and linked with speech, lead to the formation of human contacts, they cannot by themselves be regarded as *gesture language*. So-called gesture language does, indeed, include natural gestures, just as uttered speech includes so-called sound-gestures, the interjections; but these do not by themselves constitute gesture *language*. We are only justified in considering a system of gestures as language if it is entitled to be so in principle, although in comparison with uttered speech it represents a poorer and more undeveloped form of communication. Only then are

gestures, like the words of spoken language, able to convey to others our perceptions, thoughts, judgements and wishes. This happens with the help of a considerable number of kinaesthetic images, constant, articulated and variously linked with the senses.

In principle, two kinds of gesture language may be distinguished, the natural and the conventional.

Natural gesture language represents a system of signs which, in deaf mutes and occasionally in those whose hearing is normal, comes into existence spontaneously for the purpose of mutual understanding by use of natural gestures (i.e. those of themselves emerging from the situation) and habitual ones developed according to the extent of physical and mental needs. Natural gesture language takes its source material from gestures which are intuitively evident and therefore directly indicate intended persons and objects and processes. It therefore acquires a liveliness and capacity for expression which is found in uttered speech only to a slight degree. That is why gestures are very much drawn to assist and supplement spoken language. Primitive peoples, although they possess a complete spoken language, feel the need to supplement the sense of their spoken utterances by means of gestures. From reports of field investigators we gather that among primitive peoples gestures do not only have the significance of accompanying and accentuating speech, as they do for us, but form a constituent part of their linguistic understanding.[1] The intuitively evident and direct nature of gesture language lends it the character of a universal language, a peculiarity of which authors of classical antiquity were already aware. Quintilian (in his *Instit. orator* XI, 3, 87), characterizes gesture language as 'omnium hominum communis sermo'.

[1]F. Kainz, *Psychologie der Sprache*, Stuttgart, 1948, Vol. II, p. 98.

The various gesture languages, because of the many concordant natural gestures, display great similarity and are understood and acquired by those not already conversant with them after a relatively very short time. Gesture signs for concepts like 'I' and 'you'; for spatial relationships like 'above', 'below', 'to the right', 'to the left', 'in front', 'behind', 'small', 'large'; for temporal indications like 'now', 'before', 'afterwards'; for drawing, or for plastic representation of things and qualities, such as 'white', by touching the teeth, 'red', by pointing to the lips; 'fire', by blowing against the finger, or 'cow', by imitating milking.

The investigation by O. Witte demonstrates what potentialities are comprised in natural gestures, and to what extent they can represent uttered speech if they are used in conjunction with individually acquired gestures.[1] He inquires how far by means of natural gestures simple report sentences and sentence modalities like 'command' and 'question' can be conveyed to people with normal hearing. His sentences were conveyed to experimental subjects with the help of gestures corresponding to their word-sequence and the subjects were required to write down, in a sentence, what was communicated to them. It emerged that adults and children alike correctly understand a number of sentences of this type and are able to a large extent to reproduce the same literal formulation. For example: the sentence 'I have two legs', with gestural signs as follows—pointing to oneself, then indicating the legs and holding up two fingers. Ten out of twenty subjects wrote as follows: 'I have two legs'. Eight subjects wrote: 'Mr. W. (experimenter) has two legs'. Here is

[1] O. Witte, Untersuchungen über die Gebärdensprache, *Zeitschr. f. Psychologie*, 116, 1930.

another example—the sentence was: 'One can only write on the blackboard with chalk', and this was represented by natural gestures in the following manner: a writing movement first with a pencil on the blackboard, then with a steel pen-holder, then the experimenter looks at the blackboard while shaking his head in negative fashion. At this point he carries out the writing movements with chalk, and nods with his head affirmatively. One subject formulated the gesture sentence as follows: 'Writing with pencil or pen is not legible on a blackboard, but with chalk it is'. Another wrote: 'Writing with pen and pencil is not legible, but the opposite is true with chalk'.

It has become clear that the meaning of natural gesture language can be properly understood without any training or preparation, and that any sentence which is expressed in gestures can be meaningfully represented in words without difficulty. Furthermore, anybody without previous experience is able with the aid of intuitive gestures to represent an appreciable number of kinds of words like nouns, verbs, adjectives and adverbs of time and space. A bird is represented by a flying movement, a fish by a swimming movement, a snake by drawing in the air and a snake-like movement. P. Hirsch (1923), in his collection, gives about 300 different spontaneous activity gestures.

Naturally, unequivocalness cannot be invariably achieved by the gestures which are to be described because natural gesture language is not equipped with differentiation leading to unequivocalness. The gesture for 'ox' (indicating horns on one's own head) may mean 'ox', but it may also signify 'cow', 'horn' or even the devil. The restriction of the many possible meanings of the gestures which describe or indicate by drawing will be affected by the given situation. Nevertheless, a person with a certain disposition for

miming can generally express intelligibly by means of natural and spontaneously devised gestures not only individual sentences but also detailed reports on events.

Natural gesture language arises and develops necessarily among people for whom there exists no possibility of coming into mental contact with their fellows; as among deaf-mutes. Occasionally other causes can also lead to the formation of special gesture languages. Thus a gesture language arose among the Cistercian monks because spoken language was forbidden.[1] A gesture language developed of necessity among the women of certain Australian tribes. They were forced to this out of necessity because religious principles forbade a widow to speak ordinary language for twelve months after the decease of her husband counted from the day of his death.[2] There are, moreover, secret gesture languages intended to prevent strangers understanding what is said. Such languages are used by the Neapolitans,[3] Arabs,[4] and others. A more or less cultivated gesture language arises among peoples who are compelled, up to a point, to form speech-gestures because of their emotionality or insufficiency of spoken language. According to the general consensus of view among field workers, it seems that primitive man cannot dispense with gestures. Spoken language always finds support and supplementation through lively gestures. There are a certain number of situations that the primitive person (and ourselves also to a certain degree) can only express by means of an intuitive-descriptive kind of language, that is, in the first instance, by gestures.

[1]M. Taylor, *Early History of Mankind*, London, 1870.
[2]B. Spencer and F. J. Gillen, *The Native Tribes of Central Australia*, London, 1899.
[3]A. de Jorio, *La mimica degli antichi investigata del gestire napolitano*, 1832.
[4]I. Goldzieher, Über Gebärden-und Zeichensprache bei den Arabern, *Zeitschr. f. Völkerpsychologie*, 16.

A special gesture language independent of spoken language, occasionally arises in circumstances when an aid to speech seems to be entirely superfluous. Ethnological re-

31 Symbols in the gesture language of Indians in North America

search has shown that among a large proportion of primitive communities two languages exist side by side, a spoken language and a gesture language. Both languages are used; in part, each one by itself, and in part in combination with the other. Of these languages the one that has been most fundamentally investigated and described—by Mallery—is the gesture language (sign language) of the North American Indians.[1] It represents a true international language, with the help of which Indians speaking quite different languages can make themselves mutually understood. The 'gesture words' are formed by the

[1]J. Mallery, *Sign Language among North American Indians*, Washington, 1881.

position of the hand and the fingers and by their posture and movement in relation to the body (Illustration 31).

A peculiar impression is made on the observer when Indians, who do not understand a single word of the language of other Indians, spend hours relating their experiences with the aid of gestures.[1]

The question may be asked, in relation to original natural gestures, whether when both languages are used each is autonomous or the two are necessarily interdependent. Lévy-Bruhl[2] takes the first view and provides evidence for the conclusions of Cushing.[3] Cushing, who studied the language of the Zuni Indians with great industry and acute understanding, arrived at the conclusion that gesture language is as directly and, inseparably connected with thinking as it is with spoken language. Primitive man can express his thoughts equally well aloud in speech or in symbolic gestures (mostly both together). He deduces from this that neither spoken language nor gesture language is to be considered the original form out of which the other arose. Both kinds of speech seem to be direct expressions of a *unified thinking*. This idea led Cushing to place *manual concepts* side by side with *verbal concepts*, on the assumption that talking with the hand involves thinking with the hand. Cushing attributes the same function to movement-symbols in the process of thought as he does to verbal symbols. It lies outside our problem to decide what content and what phenomenal character 'these manual concepts' have and, likewise, what relationship they bear to the corresponding verbal concepts. Here we need only emphasize that the special kind

[1] F. Boas, *The North-West Tribes of Canada*, 1890.
[2] L. Lévy-Bruhl, *Les Fonctions mentales dans les sociétés inférieurs*, Paris, 1922, p. 175ff.
[3] F. H. Cushing, Manual Concepts, *American Anthropologist*, 5, p. 291ff.

of autonomous gesture language and the existence of a manual conceptual apparatus are of significance not merely for knowledge of the mental disposition of primitive people but even, if not to such an extent, for the study of the thought and imagery of deaf-mutes. In my judgement, we cannot form a correct idea of the mental development and intellectual activity of deaf-mutes if we do not form the same notion of a relationship between the intrinsic nature of gesture language and thought as we do of spoken language and thought. That the problem of so-called manual concept-formation is of particular interest alike for the general psychology of thought and speech as for developmental psychology will first emerge when we investigate it from this point of view.

The logical structure of gesture languages is closely connected with their relationship to *grammar*.

It has been categorically asserted that gesture language has *no* grammatical structure (Steinthal, Taylor). This problem was later interpreted to be one of syntax in so far as one could regard the syntactical order of words on the one hand and the sentence on the other, as interchangeable ideas. This view, which derives from Wundt (*Völkerpsychologie*), was confirmed by Hirsch and Witte in studies of people with normal hearing. According to these authors gesture language is marked by its own syntax. The usual gesture sequence of a 'gesture sentence' is: subject-object—predicate. Suppose we wish to say by means of gesture symbols: 'We are going into the garden', the sequence of gestures will express in an intuitive and generally intelligible fashion the relationships of the ideas which are represented by them if we first, point to ourselves while drawing a semi-circle with the hand in the direction of the people who are present; secondly, we point to-

wards the garden; and finally, we represent the universally known gestures for 'going'. In this manner a variety of logical and causal relationships can be rendered clear by a series of gestures in conjunction with form or descriptive representation.

This intuitive form of 'sentence building' is not peculiar to gesture language. If we have to use a foreign language in which we are not fluent, we unwittingly employ this sentence structure, in which we arrange the words together in sequence without alteration, just as gestures are arranged in gesture language.[1]

In spite of the syntactical rule which we have described and which, moreover, does not mean an unchangeably effective law of language, it is only with certain reservations that we can speak of an independent manner of gesture language. Naturally we must not lose sight of the fact that in the interpretative analysis of gesture language, we always start from the definite presupposition that the person making the communication is himself *thinking* in linguistically logical categories, and the person who is addressed *likewise*. The grammatical structure of gesture sequence is thus brought in by *us*. So the gesture language as a system has no grammatical structure; it is *we* who grasp the gestures as a significant unity and in this way bring about grammatical, logical relationships between the individual impressions.

Experience teaches us that gesture languages cannot restrict themselves to natural and habitual gestures. The growing need for communication and for mutual understanding always causes new gestures to arise which partly derive from natural gestures and partly consist of

[1]This sentence structure should not hastily be called primitive, because we find the same sentence pattern in Latin; subject—object—predicate (*pater filium laudat*).

conventionally undertaken arm and hand movements. All traditional gesture languages, both of deaf-mutes as of those sound of hearing, are to be regarded as systems of signs composed of natural and conventional gestures. In many instances, conventional symbols may also be traced back to natural gestures or may be recognized as everyday movements in a transformed guise, as Mallery has demonstrated in the case of North American Indians. Original gestures, in the course of time, undergo so many metamorphoses and changes of meaning that finally they evoke the impression that they have been invented entirely voluntarily. This is exemplified in expressing a lie by moving the mouth to the right and to the left, a way of indicating 'two-facedness'. Nevertheless, a core of sensory intuition underlies this artificial gesture symbol. But such a symbol can gradually lose its intuitive character by a process of abbreviation, and in the end, it assumes the form of a purely abstract sign of a conventional kind, without any hint that might remind us of its sensory origin.

In the developed gesture languages, there are also gesture signs which are deliberately introduced, and which are transmitted as symbols in a way similar to words in ordinary speech. In using these deliberate conventional gesture signs, we must note when we wish to go beyond the concrete, because gesture language, being intuitive and a language of the concrete, does not convey abstract ideas. The representation of the abstract, of what is in a certain measure purely ideational, is basically denied to the natural sensory sphere by describing and indicating events, things, actions, situations, perceived visually and haptically. Sentences with abstract content as for example, 'man is a social being' cannot be represented by natural gesture language, which is concrete, particular, and bound to

intuition. If we wish to indicate something abstract by means of gesture symbols, we are compelled to have recourse either to very detailed gesture-complexes, which could have many meanings, or, as in fact happens, to introduce conventional signs. The work of gesture languages by the pioneer of training for deaf-mutes, Charles Michel de L'Epée[1] provides examples of this. The most various kinds of words, concrete and abstract alike, and even grammatical categories, are given a voluntarily established sign.[2] Recently, the Catholic Institute for Deaf-mutes at St. Michielsgestel in Holland published a collection of gesture symbols which have arisen gradually with the pupils in the Institute.[3] In order to demonstrate a gesture language of this kind, let me give examples of natural and conventional gesture signals:

Intuitive Gesture Symbols

A bay may be expressed by gestures in the following manner:

One makes a semi-circle with both hands in front and then imitates the waves of the sea.

A balcony:

One draws a horizontal square and then stretches both arms out.

A watch:

One hand makes a vertical circular movement in the direction of the hands of the watch.

[1]Ch. M. de l'Epée, *L'art d'enseigner à parler aux sourds et muets de naissance*, Paris, 1784.

[2]The process of development of gesture languages is analogous to that of the Egyptian scripts. The hieratic and demotic script which the Egyptians employed apart from hieroglyphics, consists partly of simplified hieroglyphic signs and partly of invented symbols.

[3]Stift von St. Michielsgestel, Regels der gebaren toegepast bij het onderwijs aan doofstommen.

Transition from the Intuitive to the Purely Symbolical

To be bored:

The hand is moved upwards with the fingers playing and the face turned away from the other person.

Conventional Gesture Symbols

Victory:

Turning movements with both hands raised are carried out several times.

King:

One draws a circle vertically and then a line from right to left (Queen: from left to right).

Province:

One draws a bow in front of the chest from right to left.

Illustration:

The arms are stretched out and the hands alternately moved up and down a little.

University:

A scheme of a house is drawn with both hands and then the right hand is raised and moved slowly to the right.

Starting with the assumption of the primacy and primitiveness of gesture languages, scientific studies, with the aim of forming some conception of the origin of language, lead to the hypothesis that gesture language must be considered as the first form of linguistic activity out of which spoken language in due course gradually developed (Wundt, Spencer, L. Geiger, and recently van Ginneken, Tchang Tcheng-Ming, etc.).[1] But the primacy of gesture language cannot be considered probable either on the basis

[1] W. Wundt, *Die Sprache*, II, 1912, p. 648; H. Spencer, *Principles of Psychology*, 5th ed., 1890; L. Geiger, *Der Ursprung der Sprache*, 1868; J. v. Ginneken, *La réconstruction typologique des langues archaïques de l'humanité*, 1939; Tchang Tcheng-Ming, *L'Écriture chinoise et le geste humain*, Paris, 1938.

of biological arguments or on the strength of considerations of linguistic history.[1]

Living creatures make their inner states known by sounds as much as by bodily movements. There are even kinds of animal for which auditory expression has a greater significance than motor, as among birds and apes. If we consider the anatomical and physiological basis of sound production and the use of uttered speech, we can rule out the possibility that gesture language has primacy over uttered speech. As regards evidence from linguistic history, an attempt has been made to demonstrate the psychological necessity of gesture language by postulating an early stage of linguistic development in which the connexion between sign and meaning was given directly. But evidence for this assumption, in itself sensible, is lacking however, in evolution. In relation to the phylogenetic development of language, we have to rely completely on speculation. The only kind of empirical material out of which we can draw conclusions with some plausibility about the beginnings of speech are the languages of primitive tribes. But this material speaks against, rather than for, this hypothesis. There is no people, however primitive, that exclusively employs a gesture language. Even the most primitive tribes of the earth, for example, the pygmies of South Africa and Ceylon or the Hottentots, make themselves understood by spoken language which, according to the reports of students of comparative linguistics, possesses a rather complicated grammar. Even the fact that in the extremely primitive Ewe-language of the Sudan peoples in which the words are in the main composed of one syllable, existing gesture

[1]G. Révész, *The Origins and Prehistory of Language*, London, Longmans, Green & Co., 1956.

signs are superior to words and sentence-forms in intuitiveness and direct intelligibility, says nothing for the primacy of gesture language as compared with spoken language.[1] Ethnological material suggests that from the very outset man has utilized both means of communication to express his thoughts in sound-complexes and gestures, and that in the earliest period of development of contemporary primitive peoples there was a continuing mutual influence between spoken language and gestures. Both kinds of language were of significance during the early history of language, and both exercised a decisive influence on the unfolding of the outer linguistic form.

Nor are there wanting attempts to link up ontogenesis with the question of the origin of gesture languages. We cannot ignore the fact that, in many respects, gesture languages have their parallels in infant speech. In his various writings on speech in childhood, W. Stern points to the parallelism of gesture and child language in relation to the concreteness of linguistic utterances. He also draws our attention to the fact that in both forms of speech, denial, a question in denial form, and interrogatory clauses are placed at the end of the sentence; that linguistically, space was acquired before time; and, finally, that the word sequence in both kinds of language is governed by the same tendency, namely, to place the intuitive before the unintuitive and the emphasized before the indifferent.[2] A similarity between the two kinds of language cannot be denied, but it does not allow us to decide the question of the priority of gesture language in evolution. Partial likeness only shows that all forms of primitive linguistic utterance, whether they are mediated by sound or gesture, are determined by

[1] D. Westermann, *Grammatik der Ewe-Sprache*, 1907.
[2] W. und Cl. Stern, *Die Kindersprache*, 4th edit., Leipzig, 1928.

similar structural laws, which, in my view, have their basis in general psychological *laws of thinking*. This also applies to the languages of primitive peoples. From the standpoint of evolution I find the circumstance more important—and this, furthermore, favours my assumption of the contemporaneousness of both forms of language—that gestures and the first babblings of speech emerged rather early and approximately at about the same time. Be that as it may, one thing is beyond all doubt that sound and gesture languages, both among primitive and highly cultured peoples, form an indivisible unity. There are countless occasions on which we cannot express ourselves adequately without gestures. The function of gestures is not limited to the accompaniment of spoken language and to increasing its precision, but frequently also to express something which words do not express, indeed cannot express. In this way gestures acquire a constitutive significance for mutual understanding.

VI. Gesture Symbols

Gesture language is rich in *symbolic gesture signs*. It is well known that in all gesture languages, persons, wishes, activities, natural objects, natural as well as supernatural forces, etc., are represented figuratively. As I have already mentioned, countless of these symbolic gestures may be traced back to natural gestures; others, again, appear to have been freely invented and taken over by the community. We also find symbolic gestures in great numbers among peoples who otherwise do not employ any gesture language but have the need, however, to express experiences and manifestations of the will by means of gestures.

These symbolic gestures mostly derive from ancient times; many, indeed, from prehistorical epochs, handed down from generation to generation.

The gestures and posture of the hands during *prayer* belong to these traditional gestures. The question whether prayer first came into existence out of specific gestures and was only later supplemented by the accompaniment of prayer words cannot be answered with certainty. The circumstances that many primitive tribes pray to their gods with gestures cannot be adduced in support of this point of view. One thing, however, is certain, that prayer postures and gestures become conventional forms more rapidly than words of prayer become 'formulae of prayer'.[1]

Prayer postures appear in various ways and, indeed, in special relationship with the hand: in raising the hands or one or both arms, in holding both hands high above the head, in folding the hands, even in clapping the hands.

It is now generally accepted that the prayer gesture arose out of the gesture of greeting. It is noteworthy that all postures of the hands in prayer that are known to us also occur as forms and customs of greeting. This is natural, because both forms of utterances, prayer and greeting—as Heiler has shown—were originally signs of submission and subordination. Hensleigh Wedgwood's touching explanation accords with this. He suggests that the person praying with hands folded represents a prisoner who expresses his subjection and brings his hands to his conqueror for binding.[2] It is perhaps the graphic representation of the Latin *dare manus* which designates the subordination.

Apart from prayer postures, symbolic gestures in great number are found among the most varied cults on reli-

[1]Fr. Heiler, *Das Gebet*, Munich, 1923.
[2]Hensleigh Wedgwood, *The Origin of Language*, 1866.

32 Greek tomb (Museo Barocco, Rome)

gious, ceremonial, and festive occasions. We are reminded of holy rites of all religions which have remained unchanged for centuries, symbolic manipulations, hand movements and postures of sorcerers, magicians, mystics, priests, in sacred dances, symbolic purifications, sacrifices,

baptisms, blessings and dedications, with their fixed and invariable, liturgical character.

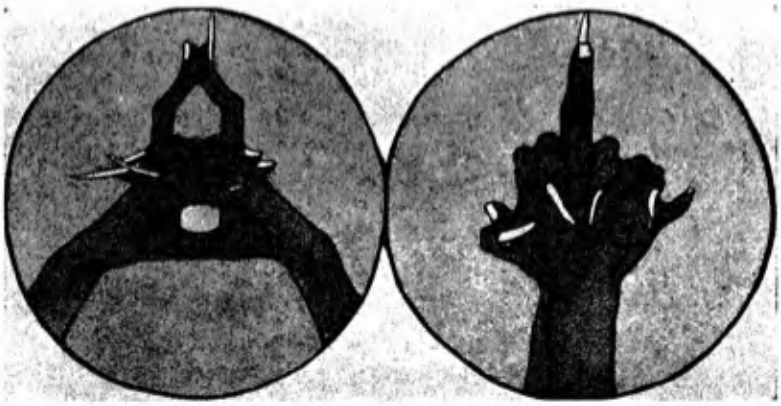
Special significance is attributed to the hand in Christian religion. The divinely inspired apostles, according to the witness of the sacred script, mediate His grace to their followers by laying the hand on them. In art, the expressive hand of God takes the place of his voice. Thus in the ceiling paintings of Michaelangelo God transfers his living spirit to man by coming near to the hand of Adam.

Hand-movements carried out on religious occasions are precisely fixed and deviations are strictly forbidden. As an instance of the symbolic function of the hand, I should like to mention that of *Mudra in Bali*. The Balinese are followers of Hinduism. Ritual ceremonies are executed by priests and by the pedanda-Buddha and the Siva priests. While serving their God, the priests carry out very characteristic hand-movements, the so-called Mudra. We cannot determine with certainty what significance Mudra now has. Whether the original intention was directed to oaths or whether Mudra belonged to the great Buddhist mysteries is an open question. Even the priests dedicated to the complex cult manipulations are not clear about the symbolism of their hand-movements nor about the significance of the individual fingers.[1]

In order to understand Mudra we shall present here some illustrations of priestly hand-movements. It is hardly necessary to point out how much practice is required by the priests before they achieve a complete mastery of the gestures (Illustrations 33 and 34).

[1]P. de Kat Angelino en Tyra de Kleen, *Mudra'sop Bali*, 1922; H. Kern, *Korte Opmerkingen over Bali*, Bijdrage Ind. Inst. Leiden, 3de volgreeks. Dl 5 en 6; J. C. van Eerde, *Hindu-Javaansche en Balische Eeredienst*, Bijdr. Ind. Inst. Leiden, Dl. 65; Kawamoura et de Milloué, *Gestes de l'Officiant dans les cérémonies mystiques dans les sectes de Tendai et Singon*, Annales du Musée Guimet. Bibl. d'études, 8.

33 Symbolic postures of the hand of Hindu priests in Bali



34 Symbolic postures of the hand of Hindu priests in Bali

In the *religious dances*, the hand acquires a constitutive significance. Anyone who has had the chance of seeing Indian or Javanese dancers knows the beauty and expressiveness of their hand-movements. Each posture has its symbolic meaning which cannot be identified from the mere gestures. Rather than show a picture of a dancer or group of dancers I would like to present (Illustration 35) a South Indian bronze statue of Siva in a dancing posture. Under the 'facial-angle' of our problem the statue evokes particular interest, for this god is represented with four hands, not two. Presumably two hands would not suffice to symbolize a manipulating Siva.

In the *social life* of peoples, the symbolic function of the hand plays no less important a role than in sacred activities. Signs of greeting of all kinds are carried out with the hand. We greet by raising the hat, we shake someone's hand when meeting him. Europeans are accustomed to greet someone by making a light movement with the right hand, the Mohammedan crosses his arms over his chest, the Indian touches his forehead with his right hand, the Roman raises his arm aloft, the bishop, when greeting someone, extends his hand to be kissed.

Besides forms of greeting, we can call to mind numerous occasions when the hand or a hand-movement symbolizes an activity, duty, or other social mode of behaviour and relationship. A few examples may be mentioned: during the marriage ceremony the priest joins the hands of the betrothed couple; we praise fidelity with raised hands or by clapping the hands; we exchange rings as a symbol of 'eternal' devotion.

In *law* the hand symbolizes the legal validity of an action: we complete a transaction by a handshake; we declare an oath with the raised hand or by touching the

Bible; a contracting party confirms his identity with his own signature. In Roman law, the hand (*manus*), symbolizes power, ownership, taking possession. 'Manu-

35 The dancing Siva (Nataraja)

mission' signifies liberating slaves from *potestas dominica*. *Manu captum, mancipium* expresses occupation by force; *manu mittitur* indicates returning a power hitherto exer-

cised. Under *mancipatio*, Roman law understands the sale of a woman under solemn rites. In *reivindicatio in jure per sacramentum* the parties who are contending in the presence of the judge for the seizure of an object engaged in a sham fight with weapons in their hands.[1]

[1]G. May, *Éléments du Droit Romain*, Paris, 1922.

VI

The Magical Significance of the Hand

MAGICAL activities have the aim of placing occult, supernatural and secret powers at the service of man. Certain people and articles like amulets, idols and fetishes are supposed to exert a magic effect. They are believed to have the secret power of guarding man from sickness and misfortune and of endowing him with fertility, strength and riches. In magic, it is always a question of a capacity transferred by supernatural powers to definite individuals whereby the fulfilment of human desires is compelled by means of hidden secret forces, even against nature and moral laws.[1]

Among all primitive peoples we find ceremonial acts as consequences of magical ideas. Such capacities and the belief firmly rooted in them may be established at high levels of cultural development. When a primitive man flings his spear at something representing a desired target or before embarking on a hunt or engaging in battle, and even in initiation ceremonies or similar events, he performs dances or other dramatic performances, he intends thereby to release magical influences.

We must also attribute a magical significance to many representations of men and animals and also to symbolic signs and pictographic elements.

Magical ideas certainly have exerted a strong influence on the practice of art among prehistoric and primitive

[1]M. Révész-Alexander, *Byzantijnsche Kunst in Italia*, Amsterdam, 1938.

peoples, though we cannot conclude that all plastic art can be traced to magic, as many ethnologists believe. M. Hoernes in particular, holds a different view and warns us not to regard magic as a formative force of art.[1]

Two forms of effect can be distinguished in the realm of magic: one is *positive* and designed to achieve a desired

36 Hand-figure (Adorant) made of bronze (Kiev)

end; the second is *negative* and tries to ward off the dangerous consequences of an event. The positive side of magic is particularly well exemplified in sorcery, the aim of which is to claim the help of higher powers for one's own purposes. The negative side of magic is expressed in taboo, i.e. in prohibiting certain actions in order not to succumb to magical forces.[2]

The cultured peoples of antiquity, like contemporary primitive peoples, believed that magical, demonic powers come from higher supernatural beings. These powers do not communicate with everyone directly, only through the

[1] M. Hoernes, *Urgeschichte der bildenden Kunst in Europa*, Vienna, 1915.
[2] J. G. Frazer, *The Golden Bough*, London, 1920.

mediation of certain selected persons. The intermediaries between deities and ordinary people are the magicians, sorcerers, shamans, wizards, chieftains, medicine-men, witches or whatever these 'supermen' of magical or demoniacal type in different cultures may be called. These persons derive their being and their strength from higher, invisible and powerful beings who 'have allowed themselves to conceal their heavenly brilliance behind sad earthly masks'. There are also magicians who have the idea that they did not receive their powers directly from the gods, but that they themselves created their extraordinary supernatural powers. Thanks to this capacity, they are convinced they can oppose their will even against laws of nature, and influence or actually regulate the course of natural events. They feel themselves so much in tune with the cosmos that a touch of their hand a word from their mouth, a look from their eyes is enough to halt the rain, bring moisture in a drought, accelerate the course of the sun and moon, hold up wind and storm, suppress epidemics, heal sickness, awaken someone from death, in a word: to modify the eternal laws of Nature for the welfare of the individual and the community.

Although the influence of religion and science gradually pressed back beliefs in magic, we still find its traces nearly everywhere. Relics, images, amulets, rings, etc., have not yet lost the magical power once ascribed to them. In its principles and even in its practice magic remains the same everywhere at all times in spite of religion and culture.[1]

[1]It is interesting to point out that no people triumphed over magic in intellectual life so completely as the Greeks. In the archaic world which Homer represents for us in his epics in so lively a fashion, magic does not play any significant role. Neither men nor gods possess magical power. Their influence rests, as Otto shows so convincingly, not on magical power but on the existence of nature. Nature is a great word which the Greek spirit opposes to the magic present in the primeval myths. (W. F. Otto, *Die Götter Griechenlands*, 1934, p. 47). Nor can magic be linked with the spirit of the Old Testament, with the glory and sublimity of God.

It is true that the limits and hypothetical character of our knowledge of Nature have not supported beliefs in supernatural forces, but they have allowed the possibility of these powers to remain. There are a great number of practising magnetists and hypnotists who lack medical training and who cling fast to the idea that they possess special healing powers. It is a matter of indifference for their practices as such, what they believe about the way they acquired their powers, whether they claim for them a religious basis or whether they believe in some unaccountable magical sympathy. It is a decisive fact that these men and women are fully convinced that they can influence events even if only in the microcosm, either by intensifying or restraining them.

This conviction may be justified to a certain extent if we link it with the phenomenon of suggestion. We no longer believe nowadays in secret, magical powers but we have learnt to understand the belief in such supernatural powers. We have recognized that mental influences are possible and that under specific conditions even a person's body can be modified under the influence of suggestion.

The magical (or rather the suggestive) effects are released through word, glance, act of sorcery or ceremony, by objects of all kind, or by touch. Often several methods are employed simultaneously; sometimes we are limited to one or other method.

There is no doubt about the suggestive power of the *word*. It is sufficient in this connexion to point to the immense influence of the Psalms, the power of the prophetic revelations, the influence of great ideas and proverbs, the pedagogical influence of words, and to verbal suggestion in hypnosis and in modern psychotherapy.

The eye or *look* as a magical power likewise plays a

great part in the beliefs of various peoples. As examples we may take the belief in the evil eye, *mal'occhio*, i.e. the bringing about an evil effect with the eye, and the belief in the good look, i.e. healing through the eye. In Italy, the

37 Magic hand with symbols

Balkans, and in Asia Minor such beliefs are still widespread, but elsewhere too we find residues of these magical ideas. The hypnotist uses his fascinating and penetrating look as a means of suggestion. And the snake-charmer uses his sharp and firm look to produce a paralysing effect on the movements of venomous snakes. The effectiveness of the so-called evil, healing and fascinating look is thoroughly intelligible because the suggestive effect of the look can exert a profound influence on the unconscious. The superstition, however, consists in interpreting this influence as a magical-demoniacal power of man.

As regards the *hand*, we know that from time immemorial it has been looked upon as a power-centre of a special kind. The power which streams out of the hand is believed primarily to have a healing effect.[1] Jesus heals the sick and the blind by placing his hand on the diseased part of the body. A relic of this ancient belief that holy men, chieftains and kings possess magic or supernatural powers can be demonstrated even in recent history. The belief survived in England until the seventeenth century that the king could heal scrofula ('King's evil') by touching the sick person. Frazer tells us that on St. John's Day, 1633, in the Royal Chapel at Holyrood, Charles I healed about a hundred sufferers from this disease on one occasion. His son, Charles II, according to historical tradition, is said to have touched 100,000 scrofulous persons and to have cured them. But William III refused to exercise this 'magical' influence; when he had to place his hand on a sick person, he said to him 'God give you better health and more understanding.'[2]

Mesmer, the exponent of the healing powers of magnet-

[1] J. N. Martius, *Unterricht von der Magia naturali und derselben medizinischen Gebrauch*, 1751.
[2] J. G. Frazer, *The Golden Bough*, London, 1920.

ism (animal magnetism) caused his patients to sit in a locked chain, finger-tip to finger-tip, so as to strengthen the stream of the healing magnetism. In the second stage of his work, when he tried to 'inject' the occult power of magnetism into a living person and thus unwittingly open the way to therapy by means of suggestion, he believed that forces streaming out of the fingers could produce physical and mental effects in men.

Since the time of Mesmer the hand has preserved its significance in treatment by *hypnosis*. If the hypnotist wishes to induce a deep sleep in his patient, according to Bernheim's prescription, he causes the patient to stare at two of his fingers.[1] By lowering the fingers the hypnotised person is forced to close his eyelids. In hypnotic therapy the painful part of the body is touched with the hypnotist's right hand and at the same time he explains that the pains have disappeared.

It is also well-known that in *spiritual* seances those present come into contact with the medium by sitting together at a table and forming a chain by touching hands. In spiritual seances a belief in the magical power of the hand is expressed particularly in the use of the so-called planchette. The planchette is a small three-legged table with a plate and pencil attached to one of the legs. This small table is placed on a page of paper. If someone places the hand on the planchette, it soon begins to move. The pencil then writes lines, signs, letters and even sentences, on the paper. Presumably these are answers to questions put to the spirits.

Man is still under the influence of ancient ideas about magnetism from which he cannot liberate himself in spite

[1]H. Bernheim, *Neue Studien über Hypnotismus, Suggestion und Psychotherapie*, 1892. Compare P. Janet, *L'automatisme psychologique*, Paris, 1903.

of rationalistic ideas. The belief or superstition in the magical power of the hand still survives and will never die out for the simple reason that this belief can always draw new nourishment from the facts of physical influence.

This is the point at which the living, expressive hand becomes truly significant. Transmission of images, ideas, intentions and impulses of will succeeds, in suggestion, mostly through *sensory contact*, that is, by the living word, by the seeing eye, and by the touching *hand*. Sensory contact through physical touch by means of an expressive organ, such as the hand, creates a congenial psychical state for transmitting mutual influences.

In this sense, the hand forms the bridge between the psychic and somatic spheres, and produces a link of sympathy between people. It is not a magic fluid, but physical warmth, personal proximity, devotion, readiness, and trust in one's own power which flow from hand to hand. A sensuously psychic feeling spreads itself through the interlocked hands. It is the hand which achieves all this, which responds delicately to all inner experiences, *the inspired human hand*.

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